The Economic Impact of
the Port of Geelong, 2004/05

A report prepared for

Victorian Regional Channels Authority
Toll GeelongPort
GrainCorp
Department of Infrastructure

Prepared by
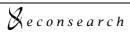
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Executive Summary

Role and Impact of Ports

The operation of a port generates employment and income for the local community, as well as flow-on effects to other local industries. In addition, all levels of government receive revenue from taxes and other charges on these activities.

In recent years, there has been increased pressure across Australia to restrict the scope of port activities in response to changing perceptions (real or otherwise) about the pollution generated by ports and the contribution to congestion on main roads. Such restrictions can reduce the efficiency of a port and the competitiveness of shippers that use the port. There may also be adverse effects on local income and employment.

Port economic impact studies can contribute to a balanced assessment of the role of ports and to informed consideration of issues such as port planning (Bureau of Transport Economics 2000).

The Port of Geelong

The Port of Geelong is the key feature of Victoria's largest provincial city, Geelong, located approximately 75 km (by road) west of Melbourne. The Port of Geelong is the second largest port in the State of Victoria, with a total throughput of approximately 12 million tonnes in 2004/05. The cargo traded during the year had an estimated value of approximately $5.6 billion.

Crude oil and petroleum products account for the majority of trade in the port in terms of volume. Grain, woodchips and fertiliser also make a significant contribution to the total volume and value of goods shipped through the port.

The major facilities at the port are located around the shore of Corio Bay, from Point Wilson in the north to Point Henry to the east. There are 14 berths available including specialist and general cargo berths. The refinery and tanker berths are located on the northern side of the port and the smelter berth is located near Port Henry in the south. There are numerous general purpose berths and wharfs and associated storage and processing facilities located between the refinery and smelter.

Conduct of the Study

The study of the Port of Geelong was undertaken using the general framework for port impact studies developed by the Bureau of Transport Economics (2000). The framework was initially applied in a study of the Port of Fremantle.

The study aimed to measure the economic impact of port-related activity at the regional and state levels. For the purposes of this study, port-related activity was defined as the activity undertaken by firms and organisations in moving cargo through the Port of Geelong and in providing goods and services to directly facilitate the movement of cargo through the port. Port impact was measured in terms of output, value added, household income and employment (refer to the Glossary for definition of these measures).

The estimates of port impact cover the direct effects of the port and the subsequent flow-on effects to other sectors of the regional and state economies. A survey with responses from 36 organisations involved in Geelong port-related activity provided the majority of the data for estimating the direct effects. An input-output table for the Barwon region and one for Victoria were used to calculate the flow-on effects to other industry sectors.

Estimates of Port Impact

Tables 1 and 2 present estimates of the overall impact of the Port of Geelong at the regional and state levels, respectively, incorporating the direct and flow-on effects.

Direct effects

The **direct impact** of port-related activity on output, value added, household income and employment is shown in the first column of Table 1 (Table 2 for Victoria). The value of output, estimated to be $170 million, is the sum of gross business revenue of firms defined as port-related (or that proportion of firms' revenues attributable to port-related activity), and gross expenditure by port-related government, semi-government and non-profit organisations. These are revenues generated and expenditure incurred in the Barwon region. The direct impacts are the same for Victoria as a whole.

The value added from port-related activity was estimated to be $89 million. Direct employment (full-time equivalents) was estimated to be 609, and corresponding household income was $34 million. This indicates an average gross annual income of around $55,000 for those employed in firms and organisations engaged in port-related activity. Household income includes overtime payments and income tax, although is net of payroll tax and other related charges.

Table 1   Economic Impact of the Port of Geelong, 2004/05 (Barwon)

Measure	Direct effects	Flow-on effects	Total Impact
Output ($m)	170.0	120.1	290.2
Value added ($m)	88.6	59.9	148.4
Household income ($m)	34.2	28.9	63.2
Employment[a]	609	579	1,188

a. Number of jobs (full-time equivalent).
Source EconSearch analysis.

Table 2   Economic Impact of the Port of Geelong, 2004/05 (Victoria)

Measure	Direct effects	Flow-on effects	Total Impact
Output ($m)	170.0	158.0	328.0
Value added ($m)	88.6	79.3	167.9
Household income ($m)	34.2	43.5	77.7
Employment[a]	609	776	1,385

a. Number of jobs (full-time equivalent).
Source EconSearch analysis.

Flow-on effects

The flow-on effects of port-related activity in the Barwon region total $120 million in output ($158 million for Victoria), $60 million in value added ($79 million for Victoria), 579 jobs (776 for Victoria) and $29 million in corresponding household income ($44 million for Victoria) (Tables 1 and 2).

Trade, ownership of dwellings and finance and business services are the three sectors where port-related activity has the largest impact. For all four measures of economic impact (output, value added, employment and income), over 50 per cent of the total flow-on effect occurred in these three sectors. For employment, the combined impact in these sectors was more than 50 per cent (380 jobs in the Barwon region and 416 jobs state wide) of the total employment flow-on from port-related activity.

Total impact

The operation of the Port of Geelong in 2004/05 generated, in terms of output, an estimated total impact on the Barwon economy of over $290 million and around $328 million on the Victorian economy as a whole.

Value added attributable to the operation of the port was estimated to be $148 million in the Barwon region ($168 million state wide). This was equivalent to approximately 2.1 per cent of gross regional product, which provides a measure of the overall level of economic activity in the Barwon region. In terms of the State's economy, it represented just over 0.08 per cent of Victoria's gross state product in 2004/05.

Household income generated by the operation of the port totalled $63 million in the Barwon region ($77 million in Victoria). Employment was estimated at almost 1,200 jobs (full-time equivalent), which represented 1.7 per cent of total employment in the Barwon region. At the State level, the estimated employment effect of 1,385 fte jobs was just under 0.07 per cent of Victoria's employment.

There were 543 ship visits to the Port of Geelong by commercial cargo vessels in 2004/05. The results of the analysis indicated that, on average, each ship call at the Port of Geelong involved the following impact on the economies of the Barwon region and Victoria (Table 3).

Table 3   Average impact per ship call for the Port of Geelong, 2004/05

Indicator	Barwon region	Victoria
Output	$534,000	$604,000
Value added	$273,000	$309,000
Household income	$116,000	$143,000
Jobs (full-time equivalent)	2.2	2.6

Detailed Impact Measures

Estimated port impacts have been disaggregated to identify the relative contribution of the individual port functions and cargo types. These detailed impact measures are provided for the Barwon region in Table 4 and for Victoria in Table 5.

The largest impacts, in terms of output and value added, occurred in the *land transport and storage* sector (including road and rail transport). The value of services provided by this sector was $89 million, with flow-ons to other sectors in the Barwon economy of over $56.7[1] million, which gives a total output impact of $146 million ($173 million in Victoria). The employment impact of land transport and storage was estimated to be 615 fte jobs (756 in Victoria), 330 directly in the sector and flow-on employment in other sectors estimated to be over 280. Associated household income for the 615 Barwon region jobs came to almost $29 million in 2004/05.

The *ship loading and unloading* sector, comprised mainly of bulk cargo handling, had a direct and indirect output impact of over $55 million. Employment generated directly and indirectly by this sector was measured at more than 220, with associated household income of approximately $14 million.

Table 4   Detailed measures of the total economic impact of the Port of Geelong, 2004/05 (Barwon)

Component	Output ($m)	Value added ($m)	Household income ($m)	Employment no.
Function				
Port administration	34.7	23.3	7.9	123
Ship operations	50.4	23.9	11.6	205
Ship loading/unloading	55.3	31.8	13.6	226
Land transport & storage	146.0	67.0	28.6	615
Government agencies	3.8	1.7	1.1	22
Total	*290.2*	*148*	*63.2*	*1,188*
Cargo Type				
Woodchips	68.3	33.6	14.3	284
Logs	6.9	3.7	1.6	29
Fertiliser	52.9	27.0	11.1	217
Grain	56.4	28.1	11.9	232
Other Dry Bulk	9.2	4.6	2.0	38
Aluminium Products	9.3	5.1	2.1	37
Steel Products	15.8	8.2	3.5	66
Crude Oil & Petroleum Products	49.3	26.2	11.4	200
Chemicals	6.1	3.1	1.4	25
Other Cargo	17.1	8.6	3.9	71
Total	*290.2*	*148.4*	*63.2*	*1,188*

Note   Components may not sum to totals due to rounding.
Source   EconSearch analysis.

[1]   The flow-on impact of $56.7 million is calculated as the difference between the total impact of $146.0 million and the direct effect of $89.3 million (see Table 5.6).

Table 5   Detailed measures of the total economic impact of the Port of Geelong, 2004/05 (Victoria)

Component	Output ($m)	Value added ($m)	Household income ($m)	Employment no.
Function				
Port administration	36.2	24.2	8.8	130
Ship operations	56.2	27.1	14.1	233
Ship loading/unloading	58.6	33.8	15.3	241
Land transport & storage	172.8	80.7	38.2	756
Government agencies	4.2	1.9	1.3	24
Total	328.0	168	77.7	1,385
Cargo Type				
Woodchips	78.2	38.8	18.0	335
Logs	7.6	4.0	1.9	32
Fertiliser	60.1	30.7	13.9	253
Grain	64.4	32.3	14.9	273
Other Dry Bulk	10.5	5.3	2.4	44
Aluminium Products	10.1	5.6	2.5	41
Steel Products	17.5	9.1	4.2	74
Crude Oil & Petroleum Products	54.0	28.9	13.5	223
Chemicals	6.7	3.4	1.7	28
Other Cargo	19.1	9.7	4.7	81
Total	328.0	167.9	77.7	1,385

Note   Components may not sum to totals due to rounding.

Source   EconSearch analysis.

Cargo type

The most significant cargo types in terms of the total volume of trade through the Geelong Port in 2004/05 were:

- crude oil and petroleum products,
- woodchips,
- fertiliser, and
- grain.

Together, these four commodity groups accounted for almost 80 per cent of the total port economic impact.

Impact of Port Users

In the case of the Port of Geelong, as with most other ports, there is a certain amount of economic activity in the Port's hinterland that would not occur in the local economy if the Port did not have its particular location. With the assistance of G21 – Geelong Regional Alliance Ltd, employment data were collected for ten significant port users. These are not necessarily the ten largest users of the Port of Geelong but are firms that have a high level of dependence on the Port for their local operations and have a prominent presence in the local economy. These ten firms account for direct employment of an estimated 1,736 people (full-time equivalents) in the Barwon economy. Each firm was categorised by industry sector and standard employment to

output ratios for each industry sector were applied to the employment data to estimate the value of production by these firms. These data were then used in the Barwon regional economic model to estimate the direct and indirect effects of the operations of these businesses to the local economy.

The results indicate that the ten locally based Port of Geelong users generated direct business turnover of over $1.3 billion in 2004/05 with flow-ons of $760 million giving an estimated total output impact (direct plus flow-ons) on the Barwon economy of around $2.1 billion.

Value added attributable to the operation of the ten firms was estimated to be $258 million in the Barwon region, with flow-ons of $326 million. This provided a total contribution of approximately $585 million or 8.3 per cent of gross regional product in the Barwon region in 2004/05.

Household income generated by the ten locally based Port users totalled $101 million in the Barwon region, with flow-ons of $156 million. Direct employment was estimated at 1,736 jobs (full-time equivalent) and flow-ons of 2,987 fte, giving total employment (direct plus flow-on) generated by the ten Port users as an estimated 4,723 fte. This represented around 7 per cent of total employment in the Barwon region in 2004/05.

Interpreting the Results

The estimates of economic impact from this type of analysis indicate the general magnitude of effects associated with the port's activities. They do not provide precise estimates, as only approximate data were available for some parts of the analysis.

The results of the study provide estimates of the impact attributable to activities required for the movement of ships and cargo through the port. They do not indicate net economic benefits, technical efficiency, competitiveness, trade facilitation effects or the contribution of port infrastructure to regional development.

1.   Introduction

Background

The role of ports is to provide the point of interface between land and sea transport in the transportation of cargoes in coastal and international trade. Ports facilitate inter-state and international trade by providing important elements of the basic infrastructure and services necessary for cargo shipping and exchange (ORG 1999).

The provision of this infrastructure and the general operation of a port generates employment and income for the local community, as well as flow-on effects to other local industries. In addition, all levels of government receive revenue from taxes and other charges on these activities.

In recent years, there has been increased pressure across Australia to restrict the scope of port activities in response to changing perceptions (real or otherwise) about the pollution generated by ports and the contribution to congestion on main roads. Such restrictions can reduce the efficiency of a port and the competitiveness of shippers that use the port. There may also be adverse effects on local income and employment.

Port economic impact studies can contribute to a balanced assessment of the role of ports and to informed consideration of issues such as port planning (Bureau of Transport Economics 2000).

Study brief

The requirements of the Port of Geelong study were as follows:

1. The study must utilise the general framework and methodology set out in Bureau of Transport Economics (2000) *Regional Impacts of Ports*, Report No. 101, BTE, Canberra.

2. The impact measures should be calculated in terms of:
    - Output;
    - Value-added;
    - Household income; and
    - Employment.

3. The impact measures should be able to be disaggregated in terms of:
    - Port function (i.e. the major activities undertaken within the port – Port administration, towage, pilotage, stevedoring, etc); and
    - Cargo type (e.g. general cargo, break-bulk, dry bulk, bulk liquid as appropriate for the port).

Study aims

The objective of the project was to assess the direct and indirect economic impact of the movement of cargo through the Port of Geelong. The income and expenditures of the firms engaged in port-related activity and of firms transporting freight to and from the port comprise the direct economic impact.

These direct impacts were used as a basis for assessing the indirect economic impacts of port-related activity. All impacts were measured in terms of household income, output, value added and employment. These measures are defined in more detail in the Glossary at the end of this report.

The impacts were disaggregated by major port functions, which are listed below.
- Administration
- Ship operations and ship movement
- Ship loading and unloading/cargo services
- Land transport and storage (including road and rail transport)
- Government agencies

The impacts were also disaggregated by cargo type, as detailed in the terms of reference. These are:
- Woodchips
- Logs
- Fertiliser
- Grain
- Other dry bulk
- Aluminium products
- Steel products
- Crude oil & petroleum products
- Chemicals
- Other cargo

Port-related activity

For the purpose of measuring the impact of *port-related activity* on the economy, it is necessary to have a clear definition of what comprises such activity.

Port-related activity is the activity undertaken by firms and organisations in moving cargo through the Port of Geelong and in providing goods and services to directly facilitate the movement of cargo through the port.

Included under this definition are firms that provide various maritime services such as transport firms, stevedoring companies and shipping agents. However, users of the port are not included. For example, manufacturing firms, distributors and retailers that import and export goods through the port in the course of their business, although dependent on the port to move their cargo, are not considered to be firms directly involved in *port-related activity*[2]. Also, activities related to commercial fishing and recreational boating are excluded from the definition.

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[2] Some port users are involved in cargo loading and unloading, for example, and the expenditures associated with this part of their operations are included in the analysis.

2. The Port of Geelong

The Port of Geelong is the second largest port in the State of Victoria and is the key feature of Victoria's largest provincial city. The port is located on Corio Bay, approximately 75 km (by road) west of Melbourne. The Port of Geelong handled approximately 12 million tonnes of cargo in 2004/05 with a total of 543 ship calls.

Geelong Port's major facilities are owned by Ports Proprietary Ltd and managed by Toll GeelongPort, a division of Toll Holdings Pty Ltd. In addition, GrainCorp own and operate a specialist grain pier.

Imports include; crude oil, petroleum products, fertiliser raw materials, aluminium smelting raw materials, bulk liquids, steel and pig iron. Major exports include; petroleum products, fertiliser products, grain, woodchips and logs.

Victoria has four major commercial trading ports: Melbourne, Geelong, Hastings and Portland. Geelong is the second largest of these ports behind the Port of Melbourne.

2.1 Infrastructure, Facilities and Port-related Activity

The port's major facilities are located around Corio Bay, extending from Point Wilson in the north to Point Henry in the east (Figures 2.1 and 2.2). Towards the northern end of the port is the Shell refinery and associated tanker berths. In the south is the Alcoa aluminium smelter berth. Between these are general-purpose facilities, berths and wharfs and the associated storage and processing facilities. There are 14 berths in total including specialist berths for:

- Oil and petroleum products;
- Bulk handling of grain;
- General cargo;
- Alumina;
- Coal;
- Phosphate;
- Chemicals;
- LPG; and
- Woodchips.

Transport of commodities to or from the port is generally by road or rail depending on the type of goods being transport. Products such as oil are processed at the refinery located at the port. Similarly, raw products for aluminium production are imported and used at the aluminium smelter located at the port. Only minimal quantities of these commodities are transported in their raw form from the port.

As noted earlier, the firms and organisations involved in *port-related activity* can be grouped according to their function. A brief explanation of each group is provided below and in the table of definitions, Table 2.1

Figure 2.1   Facilities at the Port of Geelong

Source: VRCA

Figure 2.2   Port of Geelong and Port Phillip Bay

Source: VRCA

(1) Administration

This function is comprised of general port management and operations.

(2) Ship operations

Three sub-groups make up the shipping group. The first of these relates to the activities of shipping lines and agents. The local expenditures incurred by these companies in the operation of their business comprise part of the shipping component of port-related activity.

The second sub-group relates to moving the ships into and out of the port. This includes towage, linesmen services and mooring and unmooring.

The third sub-group includes services provided to ships while they are in the port. Firms providing these services include ship chandlers and provedores, ship repairers and oil bunkering companies.

(3) Ship loading and unloading and cargo services

This group relates to the movement of cargo on and off the ship. For containers and other general cargo, this generally involves moving the cargo across the wharf and onto (or off) some form of land-based transport (road or rail). This type of cargo movement is undertaken by stevedoring companies. Bulk cargoes (oil, chemicals, gas, etc) are generally moved through specialised facilities, sometimes owned and operated by the importing/exporting firm.

This group also includes all those firms associated with the documentation for importing and exporting cargo (shipping and customs agents and freight forwarders), container services (container repair and storage) and fumigation.

(4) Land transport and storage

This group comprises the activities of the railways and road transport firms in moving cargo to and from the port. Only expenditures directly related to cargo moving through the port are included in this component of port-related activity. Port-related storage is also included in this category.

The Geelong Port is serviced by a system of road and rail transportation systems. There are some limitations on the Ports ability to compete for some bulk product trade due to the lack of rail access to Lascelles Wharf and Corio Quay. The Victorian Government has allocated funding to a Port of Geelong rail project which will overcome this impediment when this is completed. Connections to the port via road have also been improved.

(5) Government agencies

This group includes cargo inspection and regulation (customs, quarantine, and environmental inspections) as well as ship safety.

Table 2.1   Definition of port functions

Port industry group	*Components*
Port company operations	Planning, co-ordination & promotion Land and property management Safety and emergency response Port maintenance Dredging
Ship operation & ship movement	Shipping lines Ship managers Ship repairs and maintenance [a] Bunkering Ship chandlers/provedores [b] Marine and cargo surveyors Waste disposal Shipping channels Navigation aids Ship agents Towage operators Pilots Mooring/unmooring services [c]
Ship loading/unloading	Wharves, berths, jetties, etc. [d] Stevedoring (non-bulk) Bulk cargo loading/unloading Passenger terminals
Cargo services	Customs agents Freight forwarders Container packing/unpacking Container parks Fumigation
Land transport and storage [e]	Road transport Rail transport Storage facilities
Government agencies	Customs Quarantine Ship safety [f]

a. Only for vessels in the port for the purpose of bringing in or taking out cargo.
b. Supply of stores and provisions to ships. Excludes supplies to commercial fishing or recreational boating sectors.
c. Includes linesmen and launch service.
d. Construction and maintenance.
e. Port-related activities only. Involves movement of cargo within the port and between the port and closest inland points (eg warehouses, bonded storage).
f. Australian Maritime Safety Authority.

Several Commonwealth agencies oversee port related activities at the Port of Geelong. The Australian Quarantine and Inspection Service (AQIS) undertakes import and export inspection and certification. The Australian Maritime Safety Authority (AMSA) undertakes inspections to ensure that ships meet specified safety standards. The Australian Customs Service examines cargoes to ensure that import and export requirements and restrictions are not breached.

2.2 Cargo and Trade Patterns

2.2.1 Volume of trade

Total cargo moved through the Port of Geelong, on a tonnage basis, has been relatively steady over the five years to 2004/05 (Figure 2.3 and Table 2.2), with the greatest year-to-year variations due to fluctuations in grain production and to a lesser extent woodchips. In terms of total volume of trade through the Port in 2004/05 major commodities were:

- crude oil and petroleum products (58 per cent);

- woodchips (12 per cent);

- fertiliser (10 per cent),

- grain (9 per cent); and

- aluminium products (4 per cent).

Figure 2.3   Total trade volume through the Port of Geelong, 2000/01 to 2004/05

Source: Table 2.2

Table 2.2   Cargo traded through the Port of Geelong, 2000/01 to 2004/05 (tonnes)

Cargo Type	Tonnes				
	2000/01	2001/02	2002/03	2003/04	2004/05
Woodchips	705,086	1,271,543	1,326,732	1,167,133	1,477,155
Logs	204,019	228,122	285,093	181,713	84,623
Fertiliser	911,497	1,036,445	1,030,207	1,028,112	1,219,073
Grain	1,605,055	1,827,848	558,674	1,715,265	1,114,922
Other dry bulk	18,391	5,052	33,886	28,284	164,107
Aluminium products	443,070	497,297	423,144	430,074	432,768
Steel products	98,494	94,079	104,114	162,871	161,608
Crude oil and petroleum products	6,719,715	6,885,540	6,390,613	7,074,707	6,978,559
Chemicals	170,874	205,956	168,754	178,989	184,859
Other	343,383	343,910	340,263	245,855	288,322
Calcite	97,644	90,815	118,716	86,215	111,444
Other Break Bulk	22,700	64,166	65,518	42,428	47,730
Sulphuric Acid	159,073	139,240	138,773	115,652	122,382
Containers	0	0	0	0	0
General Cargoes	63,966	49,689	17,256	1,560	6,766
Total	**11,219,584**	**12,395,792**	**10,661,480**	**12,213,003**	**12,105,996**

Source: GrainCorp and Toll Geelong Port

Crude oil and petroleum products

Oil and petroleum product imports generally consist of crude oil for refinery processing and of refined petroleum based products. Exports are mostly of petroleum based refined products. There is a dedicated refinery jetty to the north of the port where ships are berthed.

Grain

Grain includes bagged and bulk grain, the major varieties include wheat, barley, oilseeds, pulses and rice. Grain that is handled by GrainCorp is through a relatively new specialised facility towards the northern end of the port. Grain that is exported by companies other than GrainCorp is through the Toll GeelongPort berth at Lascelles Wharf.

Forestry products

Woodchip exports are from either plantation pine, hardwood or plantation blue gum. They are shipped by three major exporters from either the Corio Quay or the GrainCorp terminal. Traditionally the majority of exports comprised of softwood chips, sourced from plantation timber. There has been an increasing amount of hardwood chips exported as plantation blue gums are reaching maturity. Hardwood chips are also sourced from old growth forests in the Gippsland region. Softwood chips are transported either via road or rail to the port where they are chipped and stored adjacent to the wharves (DoI 2004).

Bulk logs are generally stored near the pier in leased storage facilities and then transported by truck to the wharves. Logs exported in bulk are mostly softwood for overseas pulp production and some for sawn timber production (DoI 2004).

Fertiliser

Fertiliser trade comprises of imports of raw materials and export of manufactured products. Sulphuric acid is imported and used in fertiliser production.

Aluminium

There is a dedicated smelter berth at the southern end of the Port of Geelong where the majority of smelter related raw material imports are unloaded. A small amount of the smelter's output (aluminium in ingot form) is transported to Lascelles Wharf for export. The majority of ingots are transported via road to domestic destinations.

2.2.2 Value of trade

In line with the steady volume of products traded through the Port, the total value of the cargo has been relatively stable in recent years. Table 2.3 shows that in the five years to 2004/05 the value of trade through the Port fluctuated between $4.5 billion and $5.7 billion, averaging just over $5.1 billion for the five year period.

Table 2.3   Estimated value of cargo shipped through the Port of Geelong, 2000/01 to 2004/05 ($m) [a]

Cargo Type	Value ($m)				
	2000/01	2001/02	2002/03	2003/04	2004/05
Imports					
Dry Bulk	900	1,055	818	591	943
Liquid Bulk	2,156	1,907	1,939	1,991	2,730
Other	498	492	152	161	269
Total Imports	*3,555*	*3,454*	*2,909*	*2,743*	*3,943*
Exports					
Dry Bulk	573	767	422	611	553
Liquid Bulk	929	865	838	902	810
Other	342	555	383	306	266
Total Exports	*1,844*	*2,187*	*1,643*	*1,819*	*1,628*
Total Trade	***5,399***	***5,641***	***4,552***	***4,562***	***5,571***

a. Average annual prices were estimated for each commodity and applied to the trade volumes specified in Table 2.2.

Source: ABS (2005), ABARE (2004), ANU (2004), Department of Primary Industries (2005), Forestry SA (2005), EconSearch analysis.

3. Methods and Data Collection

This section describes the method used to estimate the economic impact of the Port of Geelong. As required in the project brief, the approach adopted for this analysis follows that described in Bureau of Transport Economics (2000). The data collection procedures are also detailed in this section, describing the survey of port-related firms and organisations, the aggregate port data compiled by the study's principal proponents (Victoria Regional Channels Authority, Toll GeelongPort and GrainCorp) and the preparation of the Barwon region and Victorian input-output tables for 2003/04. The concept, nature and methodology of impact measurement at the regional level are described in general terms in Appendix II.

3.1 General Approach

The general approach is presented in a number of steps, although they did not always occur as discrete stages and were often carried out concurrently. They are listed in summary form and discussed in more detail below.

Summary of Methodology

Step 1   Preparation of input-output tables.
Step 2   Definition and estimation of the economic structure of each port-related sub-sector.
Step 3   Definition of cargo sectors.
Step 4   Estimation of total port-related activity.
Step 5   Final table adjustment.
Step 6   Estimation of the economic impact of the port.

These steps are now described in more detail.

Step 1   Preparation of input-output tables for the Barwon region and Victoria

An input-output table for the Barwon region was available for this study (G21) although a model needed to be constructed for Victoria. The database and table were constructed largely from secondary sources, although these were supplemented with some primary data. The process of constructing the Victorian state model is described in Section 4.1 below.

Step 2   Definition and estimation of the economic structure of each port-related sub-sector

Total port-related activity was disaggregated into five categories of port-related activity (sub-sectors), detailed in Section 2. In order to represent port-related activity in the input-output table for impact estimation, it was necessary to estimate the economic transactions directly attributable to each of these industry sub-sectors. In effect, this required the estimation of the cost structures of the sub-sectors and identification of that expenditure which occurred inside and outside the Barwon region and Victoria. This expenditure corresponds to the first round of the total economic impact of each sector in the economy.

The cost structures of the industry sub-sectors were derived from a survey of port-related firms. Details of the survey are provided in Section 3.2 below.

Step 3   Definition of three cargo sectors

The five port-related sub-sectors described in Step 2 above represent the various port-related activities on a functional basis, i.e. the contribution of each of these functions to the total economic activity of the Port of Geelong. These functions can be applied to the whole range of cargo types handled through the port. It was therefore important to identify the extent to which each cargo type contributed to the activity of the port. This type of information is useful for planning purposes, since it will frequently be the case that estimates of the expected future demand for the services of the port will be available more readily in terms of cargo type than in terms of port-related functions[3].

For these reasons, ten cargo sectors, as detailed in Section 2.2, were identified for separate representation in the impact estimation procedure. These cargo types were distinguished largely by method of handling; for example, the different handling requirements of dry bulk cargoes and general cargoes impose different mixes of support service requirements in the port.

The estimation of the rows and columns representing the different cargo types in the input-output table was undertaken by allocation of the rows and columns representing the different sub-sectors (step 2) to the three cargo sectors. This was done according to the estimated requirements of each cargo group of the services provided by each sub-sector.

Step 4   Estimation of total port-related activity

Total port-related activity was calculated by aggregating the estimates derived for the seven sub-sectors defined in Step 2. This provided an indication of the total direct contribution of port activity to the economies of the Barwon region and Victoria.

Step 5   Final table adjustment

The preceding steps provided the necessary basic data for the impact estimation process. Step 5 involved the insertion into the input-output table of the rows and columns developed for representation of the five port-related sectors and the three cargo groups. Adjustments were carried out to comply with certain technical requirements of the input-output technique, including the avoidance of double counting and the subtraction of these 'new' sectors from the existing sectors of the table.

Step 6   Estimation of the economic impact of the Port of Geelong

The completion of Step 5 provided an input-output table with rows and columns showing the five port-related sectors and another table showing the ten cargo sectors. These rows and columns represented the direct impact of the port sectors on the economy of the Barwon region. The final stage of the study involved the manipulation of the input-output table (calculation of multipliers) to produce estimates of the direct

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3   The limitations of making such estimates are referred to in Section 5.3.

and indirect impacts of these sectors on the Barwon regional and Victorian state economies.

The results of this step are discussed in detail in Sections 5 and 6.

Some Technical Notes

It is important to note two points relating to the impact methodology. These relate to:

1. The use of 'representative years'. To preserve uniformity, data collection was directed at establishing the level of economic activity of each component of port-related sector in the same year, i.e. 2004/05. Problems associated with studies of this nature inevitably arise, namely with respect to overlapping financial years and abnormal conditions. These problems were met by attempting to ensure that the rows and columns representing each component in the appropriate input-output tables were as faithfully representative of a normal trading year as the data allowed.

2. Double counting. Port-related activity shows a high degree of integration within the Barwon regional economy, with consequent high intersectoral linkages between components of the industry. Since the input-output table by its nature measures the strength of backward linkages, double counting of backward linkages can occur if the multiplier effects of linked industries are simply summed. This study has been undertaken in 'net' terms, i.e. by ensuring that double counting of impacts attributable to different components of the industry does not occur. This has been achieved by expressing the value of output of each component net of backward linkages between components of the industry.

3.2   Survey of Port-related Firms

Questionnaire

A series of succinct questionnaires were prepared for completion by firms and government agencies that undertake economic activity in, or related to, the Port of Geelong. The questions were designed to elicit the scale of the respondent's port-related activity, the amounts paid by the respondent to other parties for the labour and other inputs used in such port-related work, and the amounts of revenue received from customers in payment for such work. For both payments and receipts, information was sought on how the amounts were divided between parties located within, and parties located outside, the Barwon region. The full questionnaires are reproduced in Appendix I.

Prior to receiving the questionnaire each organisation was contacted either in writing or by phone, encouraging them to participate in the survey. A covering letter for the questionnaires was also prepared, encouraging individual organisations to participate in the survey. It outlined the background and objectives of the study, explained why the survey was required and indicated that all survey data would be treated in confidence.

Organisations who received the questionnaire

The Victorian Regional Channel Authority, Toll Geelong Port and Geelong Manufacturing Council lists of clients was used as a basis for preparing a comprehensive list of port-related firms and organisations. The final list comprised

some 60 organisations (including a few government departments who provide services, such as AQIS) and approaches were made to all of these.

The port industry (loosely defined, to also include trucking companies that serve the port) is marked by a considerable degree of interlocking ownership and control. There is also a fair degree of such interconnection among large, well-known companies who are principally port users, but who also undertake some port-related activity. As a consequence, separate questionnaires sent to organisations with distinct trading names sometimes met each other inside the same head office.

This interlocking made it difficult to gauge the extent of coverage of some sub-sectors, and even makes it difficult to say how many separate companies etc. were surveyed. Nevertheless, the total figure of 55 gives a good picture (Table 3.1).

The distribution of the questionnaire to these companies was undertaken by EconSearch. The questionnaires were sent by post or email, and detailed follow-up was undertaken by telephone, fax and e-mail.

Responses

A minority of respondents completed the questionnaire upon receipt or soon after. But most did not. While many firms were eventually persuaded to complete the questionnaire, there remained a number of companies who did not. The consultants emphasised to these firms, as to all other respondents, that in reporting the results of the study, data would be aggregated not only within each sub-sector but also, in appropriate cases, across sub-sectors, to conceal the data for each individual firm, and to prevent inferences being drawn about the activities of the individual firm. These assurances led to some firms providing their data, but others still felt unable to respond.

Towards the end of this data-collection work, the numbers of responses in the various sectors were examined. Selected non-respondents were asked to give some very limited information about number of employees and estimated market share. Those firms thus approached did provide information (which has been used in calculations made to estimate sub-sector totals by extrapolation from the details provided in the completed questionnaires).

Although there is no simple statistic for "the response rate", Table 4.1 summarises the nature and extent of the various kinds of responses that were obtained in this part of the data-collection task.

Table 3.1   Responses to Geelong port industry survey

Total number of firms approached	63
- of these, number of firms found not to undertake any (significant) port-related activity in Geelong in 2004/05	8
Net total of firms from whom data were sought	55
Number of firms who completed a questionnaire	36
Number of firms who did not provide data	19

Safeguarding and processing of the questionnaires

Upon receipt of a completed questionnaire, the responses were scrutinised for comprehensiveness and internal consistency. In a few cases, relationships between reported amounts seemed to be incorrect or unusual; telephone discussion invariably resolved the problems, allowing corrected data to be recorded.

Also upon receipt, identification of the company was separated from the statistical return. The latter was coded, and the company identification stored in a separate place, to enhance the security of the storage arrangements. The returned questionnaires and the electronic data recorded from individual returns have been destroyed.

3.3 Aggregate Data Collected from GrainCorp, Toll GeelongPort and VRCA

The survey data were complemented with information provided by GrainCorp, Toll GeelongPort and VRCA. These statistics provided information on cargo tonnages and estimates of various ship and cargo costs broken down by commodity type. These costs included wharfage, pilotage, navigation services, ships utilities and site occupation. Data were also provided on ship numbers, on a cargo type basis.

The data related to the study period of 2004/05. Much of the information provided a useful cross-reference against data obtained from the survey.

4. Input-output Table and Port-related Multipliers

4.1 Preparation of the Input-output Tables

Input-output tables are constructed in several ways, namely:

    (i)   collecting detailed data from all firms in the economy using survey methods;

    (ii)   applying various statistical and estimation methods involving essentially no survey work; or

    (iii)   any level of combination of both (i) and (ii).

In practice, some form of method (iii) is generally chosen, since:

- detailed surveys are costly in terms of data collection, processing and the length of time before a table is compiled; and

- entire non-survey methods generally lack statistical accuracy and are less than entirely satisfactory despite the table being less expensive and quicker to produce.

There exists in Australia the challenge to find cheaper methods of constructing tables, particularly at the regional level. A research group at the University of Queensland developed the so-called GRIT (Generation of Regional Input-output Tables) method, appropriately termed a "hybrid" method which utilises survey, or superior data, and computer methods to generate tables (see Bayne and West 1991). It allows the analyst to exercise judgement as to how much "hard" data are needed to construct a suitable table. In addition, analysts can focus resources on the important elements or sectors of the region. This method has come to dominate the construction of regional input-output tables in Australia.

The input-output table for the Barwon region (Figure 4.1) was provided by G21. the Victorian model was constructed using the GRIT method supplemented by data gathered from a variety of other sources. The tables should be considered in the context of 'holistic' accuracy, whereby they can be viewed as being generally representative of the sectors of their respective economies although no particular cell may be entirely accurate in itself.

In this study the preliminary tables were developed by applying the GRIT procedure and subsequently adjusted and refined using additional data. The computer program used to make these adjustments was the IOW program, developed by West (2005).

The construction of the Victorian input-output table and specification of primary industry sectors in the input-output table required the collection of a considerable quantity of data. The data were collected from the Australian Bureau of Statistics, and other local and state public sector agencies.

Figure 4.1   Map of the Barwon region

Source: G21 Geelong Regional Alliance Ltd.

4.2   Estimation of the Flow-on Effects

The input-output tables, modified so as to include Geelong port-related activities[4], were used to prepare the port-specific multipliers. The essence of impact measurement is the empirical measurement of the relationship between cause and effect, or between the impacting agent and the expected impact. This relationship can be expressed in terms of a multiplier.

In this study, output, income, employment and value added multipliers were used to express impacts in terms of a 'per unit of output of port-related activity'.

Each multiplier can be disaggregated into a number of components, differentiating the direct and flow-on effects of port-related activity. *Direct effects*, sometimes referred to as *initial effects*, are the stimulus for the impact analysis and correspond, in this analysis, to port-related activity. *Flow-on effects* measure the economic activity in other sectors of the economy in response to the initial stimulus. The various multiplier components are shown in Table 4.1.

Flow-on effects are divided into two components, *production-induced effects,* which are a measure of business-to-business transactions, and *consumption-induced effects*, which represents the expenditure of household income received as payments for labour used in producing the additional output. Production-induced effects can be further divided into *first-round effects* and *industrial-support effects*.

Table 4.1   Input-output multiplier components

Multiplier component	Description
Direct (initial) effect	The stimulus for the impact analysis – normally assumed to be a dollar change in sales to final demand
Flow-on effects:	
-Production-induced effects:	
First-round effects	Refers to the purchases of inputs required from other sectors in the economy in order to produce the additional output
Industrial-support effects	Refers to second, third and subsequent-round industrial flow-on effects triggered by the purchases in the first round
-Consumption-induced effects	Stem from the spending of household income received as payments for labour used in producing the additional output
Total effect	Direct effect+ flow-on effects
Type I multiplier	(Direct + production induced)/direct
Type II multiplier	(Direct + production induced + consumption induced)/direct

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[4]   Section 3 of this report and BTE (2000, pp. 96-97) describe the process of modifying input-output tables and preparing port-specific multipliers.

Utilising the Barwon and Victorian input-output tables, which incorporated the Port of Geelong sector, a range of multipliers were calculated for the various dimensions of impact analysis required in the study brief. Aggregate multipliers are shown in Tables 4.2 to 4.5. Disaggregated multipliers are provided in Appendix IV for the Barwon region and Appendix V for Victoria.

Multipliers are usually presented in 'per unit of output terms', as they are here. The port sector output multiplier in the Barwon region (Table 4.2) can be interpreted as follows: an initial $1 of output in the port sector leads to a flow-on effect in other sectors of the Barwon regional economy of 71 cents, giving a total effect of $1.71. Each dollar of output also generates 20 cents in direct household income (i.e., wages and salaries paid to employees of port-related firms and organisations) and a further 17 cents to workers in associated industries. Similarly, each dollar of output results in 52 cents in value added in the port sector and a further 35 cents in value added in other sectors of the economy.

Employment multipliers are expressed in terms of jobs per *million* dollars of output and relate to full-time equivalent jobs. In Table 4.2, the direct effect of 3.6 jobs per million dollars of output in the port sector results in 3.4 jobs in other sectors of the economy, realising a total effect of 7.0 jobs per million dollars of port sector output.

Table 4.2   Multipliers for Geelong port industry, 2004/05 (Barwon)

Measure	Direct effects	Flow-on effects	Total Impact
Output[a]	1.00	0.71	1.71
Value added[a]	0.52	0.35	0.87
Household income[a]	0.20	0.17	0.37
Employment[b]	3.6	3.4	7.0

a. Dollar impact of $1.00 of output in port industry.

b. Number of jobs (full-time equivalent) per $million of output in port industry.

Source EconSearch analysis.

Utilising the Victorian input-output table, multipliers for the Geelong port industry were calculated for Victoria as a whole and are presented in Table 4.3. The direct effects are identical to those for the Barwon region; however the flow-on effects are greater, reflecting the additional linkages the Port of Geelong has with the broader Victorian economy. The interpretation of the multipliers is the same as for the Barwon region.

Table 4.3   Multipliers for Geelong port industry, 2004/05 (Victoria)

Measure	Direct effects	Flow-on effects	Total Impact
Output[a]	1.00	0.93	1.93
Value added[a]	0.52	0.47	0.99
Household income[a]	0.20	0.26	0.46
Employment[b]	3.6	4.6	8.1

a. Dollar impact of $1.00 of output in port industry.

b. Number of jobs (full-time equivalent) per $million of output in port industry.

Source EconSearch analysis.

As noted earlier, multipliers were estimated not only for the port as a whole but also for the port activity disaggregated on the basis of port function (port company operations, ship operations, etc.) and cargo type (woodchips, grain, etc.). These multipliers are presented in Table 4.4 for the Barwon region and Table 4.5 for Victoria. Note that in both tables they are *total* multipliers, as defined in Table 4.1, and correspond to the "Total Impact" multipliers presented in Tables 4.2 and 4.3.

Table 4.4   Multipliers for components of Geelong port industry, 2004/05 (Barwon)

Port component	Output [a]	Value added [a]	Household income [a]	Employment [b]
Function				
Port administration	1.72	1.16	0.39	6.1
Ship operations	1.95	0.92	0.45	7.9
Ship loading/unloading	1.67	0.96	0.41	6.8
Land transport & storage	1.63	0.75	0.32	6.9
Government agencies	2.30	1.04	0.68	13.5
Total	*1.71*	*0.87*	*0.37*	*7.0*
Cargo Type				
Woodchips	1.67	0.82	0.35	6.9
Logs	1.70	0.91	0.39	7.1
Fertiliser	1.69	0.86	0.35	6.9
Grain	1.69	0.85	0.36	7.0
Other Dry Bulk	1.71	0.85	0.36	7.0
Aluminium Products	1.74	0.96	0.40	7.0
Steel Products	1.69	0.88	0.38	7.0
Crude Oil & Petroleum Products	1.79	0.95	0.41	7.3
Chemicals	1.86	0.95	0.43	7.7
Other Cargo	1.79	0.90	0.40	7.5
Total	*1.71*	*0.87*	*0.37*	*7.0*

a. Dollar impact of $1.00 of output in port industry.

b. Number of jobs (full-time equivalent) per $million of output in port industry.

Source EconSearch analysis.

Table 4.5   Multipliers for components of Geelong port industry, 2004/05 (Victoria)

Port component	Output [a]	Value added [a]	Household income [a]	Employment [b]
Function				
Port administration	1.80	1.20	0.44	6.5
Ship operations	2.18	1.05	0.55	9.0
Ship loading/unloading	1.77	1.02	0.46	7.3
Land transport & storage	1.93	0.90	0.43	8.5
Government agencies	2.56	1.17	0.79	14.6
Total	*1.93*	*0.99*	*0.46*	*8.1*
Cargo Type				
Woodchips	1.91	0.95	0.44	8.2
Logs	1.87	1.00	0.46	8.0
Fertiliser	1.91	0.98	0.44	8.1
Grain	1.93	0.97	0.45	8.2
Other Dry Bulk	1.95	0.98	0.45	8.2
Aluminium Products	1.89	1.05	0.47	7.7
Steel Products	1.88	0.98	0.46	8.0
Crude Oil & Petroleum Products	1.96	1.05	0.49	8.1
Chemicals	2.05	1.06	0.52	8.6
Other Cargo	2.00	1.01	0.49	8.5
Total	*1.93*	*0.99*	*0.46*	*8.1*

a. Dollar impact of $1.00 of output in port industry.

b. Number of jobs (full-time equivalent) per $million of output in port industry.

Source   EconSearch analysis.
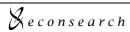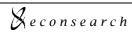
5.   Economic Impact of the Port of Geelong

This section presents estimates of the regional and state impact of the Port of Geelong in terms of output (gross revenue/expenditure), value added (payments to primary inputs of production), household income and employment. Detailed impact measures cover the impact attributable to individual port functions, commodities, and cargo types.

Although output provides a readily understandable indicator of economic activity, problems of double counting can arise when the output of a number of firms are aggregated to give an industry view. For example, if the output of the Port Administration is added to the output of the firms that provide services to the administrative firms (e.g. dredging services, pest control, etc), then the value of those services will be counted twice in the aggregate figure. A more appropriate indicator of the port's relative contribution to the State's economy is value added (payments to primary inputs of production, i.e. gross operating surplus plus wages and salaries). Value added can be directly compared to gross state product and it avoids the problem of double counting.

5.1   Overall Impact

Tables 5.1 and 5.2 present estimates of the overall impact of the Port of Geelong at the regional and state levels, incorporating the direct effects and the flow-on effects.

Direct effects

The ***direct impact*** of port-related activity on output, value added, household income and employment in the Barwon region is shown in the first column of Table 5.1 (Table 5.2 for Victoria). The value of output, estimated to be $170 million, is the sum of gross business revenue of firms defined as port-related (or that proportion of firms' revenues attributable to port-related activity), and gross expenditure by port-related government, semi-government and non-profit organisations. These are revenues generated and expenditure incurred in the Barwon region. The direct impacts are the same for Victoria as a whole.

The value added from port-related activity was estimated to be $89 million. Value added refers to the difference between the total revenue of a firm and the cost of bought-in materials, services and components. It represents payments to the primary inputs of production (labour, capital and land), and can be used to describe the contribution of an industry to gross regional (or state) product.

Table 5.1   Economic impact of the Port of Geelong, 2004/05 (Barwon)

Measure	Direct effects	Flow-on effects	Total Impact
Output ($m)	170.0	120.1	290.2
Value added ($m)	88.6	59.9	148.4
Household income ($m)	34.2	28.9	63.2
Employment[a]	609	579	1,188

a. Number of jobs (full-time equivalent).

Source   EconSearch analysis.

Table 5.2   Economic impact of the Port of Geelong, 2004/05 (Victoria)

Measure	Direct effects	Flow-on effects	Total Impact
Output ($m)	170.0	158.0	328.0
Value added ($m)	88.6	79.3	167.9
Household income ($m)	34.2	43.5	77.7
Employment[a]	609	776	1,385

a. Number of jobs (full-time equivalent).

Source EconSearch analysis.

Direct employment (full-time equivalents) was estimated to be 609, and corresponding household income was $34 million. This indicates an average gross annual income of around $55,000 for those employed in firms and organisations engaged in port-related activity. Household income includes overtime payments and income tax, although is net of payroll tax and other related charges.

Flow-on effects

As described earlier, input-output multipliers can be used to estimate the ***indirect (flow-on) impact*** of Geelong port-related activity on the economy of the Barwon region and Victoria. Multipliers were used to calculate flow-on effects for each of the four economic indicators: output, value added, employment and household income, and are shown in Tables 4.2 and 4.3.

The flow-on effects of port-related activity in the Barwon region total $120 million in output ($158 million for Victoria), $60 million in value added ($79 million for Victoria), 579 fte jobs (776 for Victoria) and $29 million in corresponding household income ($44 million for Victoria) (Tables 5.1 and 5.2).

Flow-on impacts from port-related activity occur in many sectors of the Barwon and Victorian economies. A unique characteristic of the input-output model is the facility to calculate the size of the flow-on multiplier and the extent of the impact in each of the other sectors in the local economy. The sectoral distribution and ranking of the indirect (flow-on) impacts, in terms of output, value added, employment and household income, are shown in Table 5.3 for the Barwon region and Table 5.4 for Victoria.

The ranking of sectors is determined, to a certain extent, by the labour intensity of the impacting industry (in this study, the Geelong Port sector). Generally, if the industry is labour intensive and direct purchases of goods and services by firms in the industry are relatively small, then the flow-on effects will occur predominantly in those sectors providing goods and services to households, i.e. those sectors where households spend the wages and salaries earned working in the impacting sector. It will be these sectors which are ranked highly in terms of economic impact.

Table 5.3   Flow-on effects for the Port of Geelong by industry sector, 2004/05 (Barwon)

Sector[a,b]	Output ($m)	Value added ($m)	Household income ($m)	Employment no.
Finance, business services	23.3	11.7	6.8	95
Wholesale and retail trade, etc.	24.0	11.7	7.9	200
Ownership of dwellings	10.7	9.3	0.0	0
Manufacturing	21.2	6.0	3.0	58
Transport, storage (excl port)	7.5	3.3	1.7	27
Communication	4.6	2.7	1.1	15
Community services	4.6	3.8	3.1	53
Recreation, personal services	6.0	3.1	1.9	44
Utilities	4.9	2.6	0.6	9
Accommodation, restaurants, etc.	6.2	2.6	1.5	42
Construction	2.7	1.2	0.5	13
Primary	2.8	1.0	0.3	13
Public administration	1.4	0.7	0.7	8
Mining	0.2	0.1	0.0	0
Total	*120.1*	*59.9*	*28.9*	*579*

a. Individual sectors are ranked by value added.

b. Refer to Appendix III for detailed sector definitions.

Note Components may not sum to totals due to rounding.

Source EconSearch analysis.

Table 5.4   Flow-on effects for the Port of Geelong by industry sector, 2004/05 (Victoria)

Sector[a,b]	Output ($m)	Value added ($m)	Household income ($m)	Employment no.
Finance, business services	38.7	20.0	13.1	159
Wholesale and retail trade, etc.	27.2	12.9	10.3	257
Ownership of dwellings	13.0	11.3	0.0	0
Manufacturing	30.4	8.4	4.0	87
Transport, storage (excl port)	10.3	5.6	3.6	44
Communication	7.6	4.6	2.2	30
Community services	4.6	3.7	3.2	51
Recreation, personal services	6.4	3.5	2.6	49
Utilities	6.4	3.3	0.7	10
Accommodation, restaurants, etc.	6.0	2.4	1.5	46
Construction	3.0	1.5	1.0	18
Primary	1.9	0.9	0.5	15
Public administration	1.9	0.7	0.6	8
Mining	0.8	0.4	0.1	1
Total	*158.0*	*79.3*	*43.5*	*776*

a. Individual sectors are ranked by value added.

b. Refer to Appendix III for detailed sector definitions.

Note Components may not sum to totals due to rounding.

Source EconSearch analysis.

To identify the nature of the linkage between the impacting sector and other sectors in the economy, a distinction is made between *consumption-induced* and *production-induced* flow-on effects in calculating sector multipliers. Consumption-induced effects are those brought about by household expenditures, while production-induced effects are generated by the direct purchases of local goods and services by firms in the impacting sector. Generally, in a relatively labour intensive sector the consumption induced effects will be large and the production-induced effects relatively small. The port sector has traditionally been labour intensive, but with the productivity improvements of recent years and where the majority of cargo is handled in bulk, such as at the Port of Geelong, the labour intensity is much less than was previously the case. For the Geelong Port sector, about 55 per cent of the output flow-ons were estimated to be consumption-induced and about 45 per cent production-induced. These proportions were similar for the value added, employment and household income flow-on effects (see Appendices IV and V for details).

As revealed in Tables 5.3 and 5.4, trade, ownership of dwellings and finance and business services are the three sectors where port-related activity has the largest flow-on impact. For all four measures of economic impact (output, value added, employment and income), over 50 per cent of the total flow-on effect occurred in these three sectors. For employment in the Barwon region, the combined impact in these sectors was more than 50 per cent (295 jobs) of the total employment flow-on from port-related activity (579 jobs). The corresponding figures for Victoria are 416 jobs (53 per cent) of a total state wide flow-on effect of 776 jobs.

Total impact

The operation of the Port of Geelong in 2004/05 generated, in terms of output, an estimated total impact on the Barwon economy of over $290 million and around $328 million on the Victorian economy as a whole (Tables 51 and 5.2).

Value added attributable to the operation of the port was estimated to be $148 million in the Barwon region ($168 million state wide). This was equivalent to approximately 2.1 per cent of gross regional product, which provides a measure of the overall level of economic activity in the Barwon region. In terms of the state's economy, it represented just over 0.08 per cent of Victoria's gross state product in 2004/05.

Household income generated by the operation of the port totalled $63 million in the Barwon region ($78 million in Victoria). Employment was estimated at over 1,188 jobs (full-time equivalent), which represented 1.7 per cent of total employment in the Barwon region. At the State level, the estimated employment effect of 1,385 jobs was just under 0.07 per cent of Victoria's employment.

As noted in Section 2, there were 543 ship visits to the Port of Geelong by commercial cargo vessels in 2004/05. The results of the analysis indicated that, on average, each ship call at the Port of Geelong involved the following impact on the economies of the Barwon region and Victoria (Table 5.5).

Table 5.5   Average impact per ship call for the Port of Geelong, 2004/05

Indicator	Barwon region	Victoria
Output	$534,000	$604,000
Value added	$273,000	$309,000
Household income	$116,000	$143,000
Jobs (full-time equivalent)	2.2	2.6

5.2   Components of Port Impact

Estimated port impacts have been disaggregated to identify the relative contribution of the individual port functions and cargo types. The proportion for a particular component often varies according to the impact measure being used. This variation reflects differences in factors such as profitability, capital intensity, average income and labour intensity.

Port functions

As described in Section 2, total port-related activity was partitioned into five specific functions: port management; ship movement; ship loading and unloading; land transport and storage; and government services. The dimensions of these sectors, in terms of output, value added, employment and household income, are detailed in Tables 5.6 and 5.7 for the Barwon region and Victoria, respectively.

Total multipliers were calculated for each of these port-related sectors and are shown in Tables 4.3 and 4.4. Tables 5.6 (Barwon) and 5.7 (Victoria) provide estimates of the total impacts calculated using these multipliers.

Table 5.6   Economic impact of the Port of Geelong by port function, 2004/05 (Barwon)

Function	Output ($m)	Value added ($m)	Household income ($m)	Employment no.
Direct Effects				
Port administration	20.1	16.0	4.5	55
Ship operations	25.8	12.0	5.9	92
Ship loading/unloading	33.1	20.6	8.3	118
Land transport & storage	89.3	39.3	14.9	332
Government agencies	1.7	0.6	0.6	12
Total	*170.0*	*88.6*	*34.2*	*609*
Total Impact				
Port administration	34.7	23.3	7.9	123
Ship operations	50.4	23.9	11.6	205
Ship loading/unloading	55.3	31.8	13.6	226
Land transport & storage	146.0	67.0	28.6	615
Government agencies	3.8	1.7	1.1	22
Total	*290.2*	*148.4*	*63.2*	*1,188*

Note Components may not sum to totals due to rounding.

Source EconSearch analysis.

Table 5.7   Economic impact of the Port of Geelong by port function, 2004/05 (Victoria)

Function	Output ($m)	Value added ($m)	Household income ($m)	Employment no.
Direct Effects				
Port administration	20.1	16.0	4.5	55
Ship operations	25.8	12.0	5.9	92
Ship loading/unloading	33.1	20.6	8.3	118
Land transport & storage	89.3	39.3	14.9	332
Government agencies	1.7	0.6	0.6	12
Total	*170.0*	*88.6*	*34.2*	*609*
Total Impact				
Port administration	36.2	24.2	8.8	130
Ship operations	56.2	27.1	14.1	233
Ship loading/unloading	58.6	33.8	15.3	241
Land transport & storage	172.8	80.7	38.2	756
Government agencies	4.2	1.9	1.3	24
Total	*328.0*	*167.9*	*77.7*	*1,385*

Note   Components may not sum to totals due to rounding.

Source   EconSearch analysis.

The largest impacts, in terms of output and value added, occurred in the *land transport and storage* sector (including road and rail transport). The value of services provided by this sector was $89 million, with flow-ons to other sectors in the Barwon economy of over $56.7 million[5] ($83 million state wide). Employment in the sector was measured at over 330 with associated household income of almost $15 million. Flow-on employment in other sectors was estimated to be over 280 (420 in Victoria), earning around $14 million in household income during 2004/05 ($23 million in the whole of Victoria).

The *ship loading and unloading* sector, comprised mainly of bulk cargo handling, provided services valued at over $33 million, with flow-ons to other sectors in the Barwon regional economy of around $22 million ($26 million state wide). Employment in the sector was measured at almost 120 with associated household income of approximately $8 million. Flow-on employment in other sectors was estimated to be over 100 (120 in Victoria), earning over $5 million in household income during 2004/05 ($7 million in the whole of Victoria).

The *ship operations* sector had impacts similar to the ship loading and unloading sector. Direct and flow-on employment in the ship operations sector accounted for over 200 full-time equivalent jobs (230 state wide), generating household income of over $11 million in the Barwon region (approximately $14 million in Victoria in total).

The *port administration* sector is an important component of total port-related activity, particularly in terms of direct and flow-on employment of over 120 jobs in the Barwon region (130 jobs in Victoria) and corresponding household income of $7.9 million ($8.8 million state wide). The port-related activity of *government agencies* comprises a minor component of the total port impact.

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[5]   The flow-on impact of $56.7 million is calculated as the difference between the total impact of $146.0 million and the direct effect of $89.3 million (see Table 5.6).

Cargo type

Tables 5.8 and 5.9 show the breakdown of direct and total impacts by the major cargo types traded in 2004/05 for the Barwon region and Victoria, respectively. Details on tonnages for that year are provided in Table 2.2. The interpretation of the results is the same as that described above for the various port functions.

Of the ten commodity groups, the four largest, woodchips, fertiliser, grain and crude oil and petroleum, account for almost 80 per cent of the total port impact.

Table 5.8   Economic impact of the Port of Geelong by cargo type, 2004/05 (Barwon)

Cargo type	Output ($m)	Value added ($m)	Household income ($m)	Employment no.
Direct Effects				
Woodchips	40.9	20.2	7.7	149
Logs	4.0	2.3	0.9	15
Fertiliser	31.4	16.4	6.0	111
Grain	33.3	16.8	6.3	119
Other Dry Bulk	5.4	2.7	1.0	19
Aluminium Products	5.3	3.1	1.2	18
Steel Products	9.3	5.0	2.0	34
Crude Oil & Petroleum Products	27.6	15.5	6.3	97
Chemicals	3.3	1.7	0.7	12
Other Cargo	9.5	4.9	2.1	35
Total	*170.0*	*88.6*	*34.2*	*609*
Total Impact				
Woodchips	68.3	33.6	14.3	284
Logs	6.9	3.7	1.6	29
Fertiliser	52.9	27.0	11.1	217
Grain	56.4	28.1	11.9	232
Other Dry Bulk	9.2	4.6	2.0	38
Aluminium Products	9.3	5.1	2.1	37
Steel Products	15.8	8.2	3.5	66
Crude Oil & Petroleum Products	49.3	26.2	11.4	200
Chemicals	6.1	3.1	1.4	25
Other Cargo	17.1	8.6	3.9	71
Total	*290.2*	*148.4*	*63.2*	*1,188*

Note Components may not sum to totals due to rounding.

Source EconSearch analysis.

Table 5.9   Economic impact of the Port of Geelong by cargo type, 2004/05 (Victoria)

Cargo type	Output ($m)	Value added ($m)	Household income ($m)	Employment no.
Direct Effects				
Woodchips	40.9	20.2	7.7	149
Logs	4.0	2.3	0.9	15
Fertiliser	31.4	16.4	6.0	111
Grain	33.3	16.8	6.3	119
Other Dry Bulk	5.4	2.7	1.0	19
Aluminium Products	5.3	3.1	1.2	18
Steel Products	9.3	5.0	2.0	34
Crude Oil & Petroleum Products	27.6	15.5	6.3	97
Chemicals	3.3	1.7	0.7	12
Other Cargo	9.5	4.9	2.1	35
Total	170.0	88.6	34.2	609
Total Impact				
Woodchips	78.2	38.8	18.0	335
Logs	7.6	4.0	1.9	32
Fertiliser	60.1	30.7	13.9	253
Grain	64.4	32.3	14.9	273
Other Dry Bulk	10.5	5.3	2.4	44
Aluminium Products	10.1	5.6	2.5	41
Steel Products	17.5	9.1	4.2	74
Crude Oil & Petroleum Products	54.0	28.9	13.5	223
Chemicals	6.7	3.4	1.7	28
Other Cargo	19.1	9.7	4.7	81
Total	328.0	167.9	77.7	1,385

Note   Components may not sum to totals due to rounding.

Source   EconSearch analysis.

5.3   Interpreting the Results

As noted in BTE (2000, pp107-108), the estimates of economic impact from this type of analysis indicate the general magnitude of effects associated with the port's activities. They do not provide precise estimates, as only approximate data were available for some parts of the analysis.

The results of the study provide estimates of the impact attributable to activities required for the movement of ships and cargo through the port. They do not indicate net economic benefits, technical efficiency, competitiveness, trade facilitation effects or the contribution of port infrastructure to regional development.

Data from the study may potentially be used to forecast the likely impact of increased trade through the port. However, such an assessment should not be based on a mechanistic application of multipliers estimated as part of this study. Such estimates should take account of factors such as the cargo types involved, economies or diseconomies of scale and existing capacity utilisation.

6. The Economic Impact of Port Users

Users of the Port of Geelong include a variety of companies which trade in liquid and dry bulk and break-bulk products. Some of these are large firms with large volumes of trade while others are smaller operations moving modest levels of cargo through the port each year. The activities of these firms, large and small, are, for the most part, not included in the impacts reported in Section 5 of this report. The following sections provide an overview of the significance of the Port to four Geelong based firms (Section 6.1) and an estimate of the impact that ten of the top port users have on the local economy (Section 6.2).

6.1 Examples of Local Port Users

For a range of companies the Port of Geelong is integral to the location of their operations, either as a source of inputs, as a facility for efficient export of end products or, in some cases, the infrastructure to facilitate both imports and exports. This section provides a brief description of the nature of the dependence on the Port of four locally operating firms, namely Alcoa Australia, Basell Australia Pty Ltd, Shell Co of Australia and Volclay Pty Ltd.

Alcoa World Alumina Australia

Alcoa Australia owns and operates the Port Henry smelter located at the southern end of the Port of Geelong. The Geelong smelter has the capacity to produce 185,000 tonnes of aluminium per year. Almost half of the aluminium produced at the smelter is sold to the neighbouring Alcoa Australia Rolled Products plant where it is rolled into sheets for can manufacturing.

Alcoa Australia Alumina Smelter at Point Henry, Geelong
Source: www.alcoa.com/australia/en/info_page/smelting.asp

Alcoa Australia employs approximately 1,440 full time equivalent employees in Victoria. Alcoa imports a significant quantity of raw materials used in the smelter process through the Port of Geelong. In 2004/05 Alcoa imported 360,000 tonnes of Alumina as domestic dry bulk product from Western Australia. Aluminium Fluoride sourced from the USA is also imported, totalling approximately 2,900 tonnes in 2004/05. Petroleum Coke, sourced from China and the USA, is another significant import, totalling 70,000 tonnes in 2004/05. Alcoa's use of the Port has remained relatively consistent over the last 5 years (1999/00 to 2004/05) and there are no significant changes in operation and use expected over the next 5 years (2004/05 to 2009/10). Due to the significant established infrastructure, the Geelong Port is crucial to the viability for Alcoa's local operations. Without access, raw materials would have to be shipped into another port and then transported to the smelter at Geelong. This would impose a significant increase in transportation costs and would reduce the financial viability of the operation.

Basell Australia Pty Ltd

Basell Australia operates a polypropylene plant within the refinery site at the Port of Geelong. The plant was established in 1979 and currently produces approximately

70,000 tonnes of homopolymer polypropylene plastic per year. The plastic has various commercial and consumer applications including packaging film, fibres, closures and house wares. In January 2005, Basell announced that it is planning to increase the capacity of the Geelong plant by 60,000 tonnes per year. This expansion is expected to be complete by early 2006.

Basell Australia Pty Ltd – Geelong Polypropylene Plant
Source: www.basell.com

Basell Australia operates at the Port of Geelong as a part of the refinery site and does not utilise the Port directly for import or export purposes. The Geelong plant relies upon the oil refinery as a source of raw materials required for production. Polypropylene products produced by Basell in Geelong are initially transported by road to container facilities located at other ports such as Melbourne. There are no container facilities at the Port of Geelong. This road transport comes at a significant cost both financially and environmentally. The expansion of the plant that is currently underway will significantly increase the quantity of goods requiring transport via road. The lack of container facilities limits the extent to which Basell can utilise the Port of Geelong. Other limitations include insufficient rail infrastructure, specifically a rail spur via Lascelles Wharf.

Basell's operations in Geelong have remained relatively consistent over the last five years (1999/00 to 2004/05). There are no additional changes expected over the next five years (2004/05 to 2009/10) other than the significant expansion of operations outlined above, which is currently underway. Further expansion or significant changes in operations and use of the Geelong Port would require additional services and facilities to be developed.

Basell Australia employs 56 full time equivalents excluding projects such as the plant expansion.

Shell Co of Australia

The Shell Geelong Refinery was built in 1954 and produces a large range of refinery products including petrol, liquid petroleum gas (LPG), jet fuel, diesel, bitumen and other petroleum products. Shell Co of Australia operates a refinery and specialised refinery and tanker berths on the northern side of the Port of Geelong. The Shell Geelong Refinery occupies approximately 120 hectares of land on the shore of Corio Bay. The refinery has the capacity to refine more than five million tonnes of crude oil each year. Crude oil is imported from Vietnam, Malaysia, Brunei and Indonesia. Oil is also sourced from Australia's oilfields in Bass Strait and transported via the Western Port-Altona-Geelong (WAG) pipeline.

Approximately 45 per cent of the Shell Geelong Refinery's product is transported via pipeline to Shell's Newport Terminal for distribution throughout Victoria and 40 per cent is exported from the Geelong Port via ship to Australia's coastal cities and New Zealand. The remaining 15 per cent is transported via road and rail to locations within Geelong and the surrounding areas. The refinery produces approximately 15 per cent of Australia's petroleum products. It accounts for 50 per cent of Victoria's total petroleum consumption and 100 per cent of Tasmania's petrol.
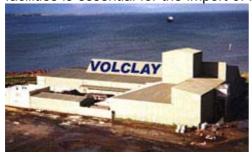
Shell Geelong Refinery
Source: www.shell.com.au

Crude oil and refinery products account for the majority of trade through the Geelong Port. In 2004/05 Shell imported 3,850,000 tonnes of crude oil and 520,000 tonnes of refined products through the Port of Geelong. Exports of refined products in 2004/05 were approximately 1,530,000 tonnes. Import and export quantities have remained relatively stable over the last 5 years (1999/00 to 2004/05). Minimal changes are anticipated over the next 5 years (2004/05 to 2009/10), with volumes expected to increase slightly. The significant established refinery infrastructure makes Shell a "captive customer" of the Port of Geelong. The Port is essential to the operations of the Shell Geelong Refinery and plays an integral role in the supply chain.

Shell Geelong Refinery employed approximately 510 people in manufacturing, supply, finance, contracts and procurement, plus up to 100 contractors during normal operations. Currently Shell employs 12 apprentices in Mechanical Fitting, Machining and Electrical/Instrument trades.

Volclay Pty Ltd

Volclay Pty Ltd accounts for a significant proportion of Australia's Bentonite and mineral supply industry, with products utilised in many diverse applications. Volclay Pty Ltd has extensive processing and storage facilities centred at Geelong, where they have immediate access to the Port's facilities. This close proximity to services and facilities is essential for the import of raw materials and the export of finished products. The majority of Volclay's imports are of minerals, predominantly Bentonite. Bentonite is a clay material that has multiple usable properties useful in industrial and commercial applications including waterproofing, dam sealing, wastewater treatment and wine clarification.

Volclay Pty Ltd processing and storage facilities – Geelong
Source: www.volclay.com.au

Volclay's operations in Geelong involve the processing, packaging and distribution of mineral clay products. Volclay employed 9 full time equivalent employees in Victoria in 2004/05. Imports included approximately 6,500 tonnes of Bentonite in 2004/05. There has been minimal change in Volclay's operations at the Port of Geelong over the last 5 years (1999/00 to 2004/05) and the company does not expect there to be significant changes over the next 5 years (2004/05 to 2009/10). The Port of Geelong is within close proximity to Volclay's processing and storage facilities in North Geelong. Due to

freight cost constraints it would not be financially viable for Volclay to transport raw materials from the nearest alternative port, the Port of Melbourne.

6.2 Economic Impact on the Barwon Economy of Ten Port Users

The main purpose of this study has been to provide an analysis of port-related activity at the Port of Geelong; the economic activity involved in the movement of ships in and out of the Port, the movement of cargo to and from the Port and on and off ships, and the ancillary services that supports this movement of ships and cargo. These various activities define the operation of the Port and, collectively, they generate, directly and indirectly, an impact on the Barwon and Victorian economies that was reported in detail in Section 5.

The results presented in Section 5 provide a contained and well-defined economic impact that is consistent with the Bureau of Transport and Regional Economics (BTRE) definition of regional port impact. The method has been applied in numerous studies of ports across Australia (e.g. BTE (2000, 2001); EconSearch (2001, 2003); EconSearch and NIEIR (2002)). The BTRE framework, quite intentionally, excludes from the calculated regional impact the economic contribution that port users have on the local economy. For example, the activities of a manufacturing firm that imports raw materials and then exports processed products through the port is not included in the BTRE definition of port-related activity. The economic activity associated with the movement of the raw material and processed product back and forth across the wharf is included, however the processing activity itself is not. In striving to develop a method that gives a consistent and comparable measure of regional economic impact, this is a reasonable approach because it would be otherwise very difficult to define in a consistent manner what manufacturing activities are attributable to the port and what are not.

Nevertheless, in the case of the Port of Geelong, as with most other ports, there is a certain amount of economic activity in the Port's hinterland that would not occur in the local economy if the Port did not have its particular location. With the assistance of G21 – Geelong Regional Alliance Ltd, employment data were collected for ten significant port users. These are not necessarily the ten largest users of the Port of Geelong but are firms that have a high level of dependence on the Port for their local operations and have a prominent presence in the local economy. These ten firms account for direct employment of an estimated 1,736 people (full-time equivalents) in the Barwon economy. Each firm was categorised by industry sector and standard employment to output ratios for each industry sector were applied to the employment data to estimate the value of production by these firms. These data were then used in the Barwon regional economic model to estimate the direct and indirect effects of the operations of these businesses to the local economy. The results of the analysis are provided in Table 6.1.

Table 6.1   Direct and flow-on effects of ten Port of Geelong users, Barwon region, 2004/05

Sector[a]	Output ($m)	Value added ($m)	Household income ($m)	Employment fte no.
Direct Effect				
Port Users	1,347.0	258.8	101.2	1,736
Flow-on Effect				
Primary	11.3	4.1	1.2	52
Mining	20.1	9.0	2.2	29
Manufacturing	276.7	72.1	34.1	606
Utilities	42.9	22.4	5.0	79
Construction	2.8	1.3	0.5	14
Wholesale and retail trade, etc.	100.0	48.0	32.8	824
Accomm., restaurants, etc.	32.5	13.5	7.7	218
Transport, storage (excl port)	59.4	26.1	13.1	216
Communication	12.4	7.2	3.0	40
Finance, business services	109.1	52.8	31.3	453
Ownership of dwellings	42.8	37.3	0.0	0
Public administration	5.7	2.9	2.7	33
Community services	20.5	16.8	14.1	239
Recreation, personal services	24.4	12.9	7.8	182
Total Flow-on Effect	760.7	326.4	156	2,987
Total	**2,107.6**	**585.1**	**256.7**	**4,723**

a. Refer to Appendix III for detailed sector definitions.

Note   Components may not sum to totals due to rounding.

Source   G21 - Geelong Regional Alliance Limited and EconSearch analysis.

The operation of the ten locally based Port of Geelong users generated direct business turnover of over $1.3 billion in 2004/05 and flow-ons of $761 million giving an estimated total output impact (direct plus flow-ons) on the Barwon economy of around $2.1 billion.

Value added attributable to the operation of these ten firms was estimated to be $259 million in the Barwon region, with flow-ons of $326 million. This provided a total contribution of approximately $585 million or 8.3 per cent of gross regional product in the Barwon region.

Household income generated by the ten locally based Port users totalled $101 million in the Barwon region, with flow-ons of $156 million. Direct employment was estimated to be 1,736 fte jobs, with flow-ons of 2,987 fte giving total employment generated by the ten Port users of 4,723 fte. This represented around 7 per cent of total employment in the Barwon region.

Appendix I   Survey Questionnaires

This appendix contains the version of the questionnaire that was sent to firms whose activities were primarily Geelong port-related.

EconSearch Pty Ltd
PO Box 746
Unley BC SA 5061
Tel: 08 8357 9560
Fax: 08 8357 2299
Email: ports@econsearch.com.au
Contact: Julian Morison or
Matthew Ferris

**PORT OF GEELONG ECONOMIC IMPACT STUDY 2004/05 –
PORT SERVICE – PROVIDERS QUESTIONNAIRE**

Please read this first:

- If exact figures are not available, please provide careful estimates.
- Please report all monetary values in **thousands of dollars** ($'000).
- An electronic version of this questionnaire can be sent to you by email, if requested.

1.   Company Information

Company Name: _____

Contact Name: _____

Contact Phone Number: _____

Port – Related Activities (see attached list): _____

_____

2. Staff numbers and associated costs incurred in Victoria related to activities through the Port of Geelong (average for financial year 2004/05, including working proprietors, managers, directors):

Full Time   _____

Part Time   _____ (total)

_____ (full – time equivalents)

Contractors   _____ (full – time equivalents)

Gross wages & salaries in 2004/05 ($'000)   _____
(including associated costs, e.g. superannuation, but excluding payroll tax)

3. What other major costs, in addition to gross wages and salaries, were incurred in 2004/05 related to activities through the Port of Geelong: (e.g. fuel, repairs and maintenance, contractors, power)

Expenditure item	($'000)	% in Barwon region	% in rest of Victoria

4. Please break down your Port of Geelong related revenue by cargo type and estimate market share for each cargo type (i.e. your firm's share of the Geelong market for that cargo type).

Cargo Type	Revenue in 2004/05 ($'000)	Estimated market share for each cargo type (%)
Woodchips		
Logs		
Fertiliser		
Grain		
Other dry bulk		
Aluminium products		
Steel products		
Crude oil & petroleum products		
Chemicals		
Other (please specify)		
TOTAL		

Thank you for your time and cooperation.

Please return the questionnaire using the enclosed reply paid envelope or fax to (08) 8357 2299.

If you have any queries don't hesitate to contact Julian Morison or Matthew Ferris on 08 8357 9560 or ports@econsearch.com.au.

Appendix II   Economic Impact Analysis

This study provides estimates of the economic impact of *port-related activity* on the economy of the Barwon region and the state of Victoria. The methodological basis for the study is input-output analysis. In this appendix the concept of economic impact, the process of impact measurement and the use of input-output models in impact measurement are briefly reviewed. The research methodology applied in this study is outlined in more specific terms in Section 3.

The input-output model is suitable for the detailed description of regional economies and for measuring the impacts of existing industries, new industries or changes in the size of industries on the regional economy. It is therefore appropriate to apply the model in estimating the impact of port-related activity on the economy of the Barwon region.

In the following sections the method of economic impact analysis is outlined and the structure of the input-output model and multipliers, the tools used in the estimation of economic impacts, are detailed.

Economic impact analysis

The term *impact* has no unambiguous meaning; it is used in a wide variety of contexts, and synonymously with several terms such as *results*, *incidence*, *effect*, *significance*, *contribution*, *consequence* and *importance*. It is therefore important to define clearly the concept of economic impact, and the particular use of the term applied in this study.

One of the main ends of economic research is the study of impacts, where the term refers generally to the consequences of some expected or hypothetical phenomenon, either physical or social. For example, the recent emergence of environmental impact statements reflects a desire on the part of authorities to be informed on the likely consequences of a new development, both in terms of effects on the physical environment and the socio-economic environment. An impact study is intended to isolate and identify the more significant consequences of an event or phenomenon for planning purposes.

It is necessary to distinguish between the *impacting agent*, which is the phenomenon or event under study, and the *impacts*, which are the results of the existence of, or change in, the impacting agent. Socio-economic impact studies tend to be restricted to the consequences of significant existing or new phenomena. These phenomena cause a wide variety of impacts to occur in economic, sociological, political, physical and welfare terms. For example, the activity associated with the port in Geelong has resulted in a wide variety of impacts on the regional, social and economic structure of Geelong and the Barwon region as a whole. Apart from the economic consequences of the port, some of which are the subject of this study, virtually every facet of the regional social structure will be affected by the existence of the port.

Since this study is concerned solely with economic impact, it omits the wide variety of non-economic impacts of the industry on the region, many of which are clearly significant. The *economic* consequence of the presence of the port will be felt in many aspects of activity in the Geelong region, ranging from levels of regional output, income and employment, to land prices (including residential, commercial and industrial land), house and building prices, local government rates, supply and demand of labour,

demand and supply of urban infrastructure and so on. Unfortunately, fully comprehensive models, including all aspects of regional economic activity, are not available and more complex econometric models with an ability to include a wide variety of economic phenomena have not been satisfactorily developed for impact analysis at a regional level in Australia.

Consistent with the BTE (2000) approach, the input-output model was considered the most appropriate for this economic impact assessment. This model is, however, limited to those aspects of impact which can be represented in the input-output model, ie output, income, employment and value added. The procedures used in input-output analysis are detailed in the following section.

While it is quite clear that significant economic and social impacts are associated with port-related activity, measurement of these impacts does not, *per se*, constitute an economic evaluation of the industry. Such an evaluation is possible only through a comprehensive cost-benefit analysis of the industry, which would take into account both the direct and indirect impacts of the industry as recorded in this study.

In summary, an economic impact may be defined in general terms as the measured economic effect of, or change which is attributable to, the impacting agent[6] on the economy in question.
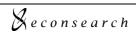
Multipliers and impact measurement

The essence of impact measurement is the empirical measurement of the relationship between cause and effect, or between the impacting agent and the expected impact. This relationship can be expressed in two ways:

(i)   on a 'per unit of impact' basis. This is normally expressed in terms of a multiplier which expresses the cause-effect relationship in empirical terms. In this study, output, income, employment and value added multipliers are used to express impacts in terms of a 'per unit of output of port-related activity'.

(ii)   on an aggregate value basis. This expresses the total absolute effect, measured in terms of output, income, employment, and value added of the existence of port-related activity.

The selection of methodology for impact measurement is therefore selection of the most appropriate method of estimation of multipliers. Four general methods are available for this purpose, namely economic base multipliers, regional Keynesian multipliers, econometric models and input-output models. The consultants had access to an established methodological and research structure for the calculation of an input-output table for the Barwon region, and to methods of calculating multipliers from these tables. There was, therefore, a distinct advantage in the use of the input-output technique, apart from the fact that it is generally considered to be methodologically superior to the simpler techniques such as the economic base approach or the use of regional Keynesian employment multipliers. This superiority is generally considered to be attributable to the following factors (Jensen and West 1986):

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[6] The impacting agent may be an actual or potential source of economic change, or an industry which is established and operating in the economy.

(i)   In terms of the incidence of impact, the economic base and the Keynesian approaches normally provide impact measurement only in aggregate terms, i.e. the total impact felt by all sectors collectively. Input-output multipliers allow the analyst to examine the manner in which the total impact is distributed among the sectors of the economy. This is a reflection of the internal linkages and interdependencies in the economy which are specified in the input-output table.

(ii)   Input-output multipliers also allow the identification of the components of the multiplier; the economic base and Keynesian models do not, in their standard form, provide all of these details. The components are as follows:

(a)   the **initial** effect, which is the stimulus for the impact analysis – normally assumed to be a dollar change in sales to final demand;

(b)   the **first-round** effect, which refers to the purchases of inputs required from other sectors in the economy in order to produce the additional output;

(c)   the **industrial-support** effect, which refers to second, third and subsequent-round industrial flow-on effects triggered by the purchases in the first round; and

(d)   the **consumption-induced** effects, which stem from the spending of household income received as payments for labour used in producing the additional output.

Regional econometric models, including models of the general equilibrium family, were not available for the region or project in question, and were not considered necessary for the view of impact taken in this study.

Input-output analysis

An outline of the input-output technique can be found in any one of a number of standard texts dealing with the subject (see, for example, Hewings (1985), Midmore and Harrison-Mayfield (1996), Miller and Blair (1985), Jensen and West (1986) and West (1993, 1995, 1999). An input-output table is a simple mathematical representation of the production aspects of an economy viewed at a particular point in time. In the purely hypothetical case of no significant change in the economy from one time period to another, the table would remain relatively unchanged over that period. In reality, any economy continually experiences many types of shocks or stimuli (positive and negative) and these may be ephemeral in nature or lead to long-term structural changes in the nature of the economy. Many of these stimuli can be represented in the input-output model by appropriate adjustments to the input-output table. Some of these methods are outlined in the following section.

Methods of impact measurement using input-output analysis

The task of measuring economic impacts through the input-output model is largely one of representing the impact in the most appropriate manner in the transactions table. Once this has been completed, the analytical derivation of the impact is possible through multiplier calculation in the conventional manner.

The responsibility of the input-output analyst is to determine the nature of the impact under study, the relationship of the impacting agent with the economy in question, and to simulate this relationship as closely as possible in the transactions table of the regional economy. Some common types of impact, requiring different treatment of the input-output table, are listed below.

> (a) A change in the level of output of a sector or sectors, due to changes in the level of final demand, may be traced by use of multipliers or by matrix multiplication using the table in its original form.

> (b) A change in the technology or trading patterns of an existing industry would be reflected in changed column or row entries in the existing transactions table. The effects of this type of change would be measured by comparing multipliers, output levels and employment levels before and after the impact occurred.

> (c) A new or existing firm or industry can be incorporated into the study in either of two ways. If the impact is regarded as of little significance, or if the firm is thought to show a cost structure (ie a column in the A matrix) similar to the average existing firm in the table, the new firm can be adequately represented by the existing sector of the table without any significant strain on the assumptions of the model. If, however, the firm or industry to be examined is considered to be of some significance, or if the requirements of the study called for a detailed study of the firm or industry *per se*, a new row and column representing that firm or industry should be prepared and incorporated into the input-output table and normal multiplier calculation carried out. Only in this manner is a detailed study of the impact of the firm or industry possible. The latter procedure was used in this study and new rows and columns were prepared for each aspect of port-related activity, as described in Chapter 3.

Limitations of input-output analysis

The input-output model, like all economic models, is not capable of a perfect or near-perfect simulation of economic reality. It is therefore important to clarify the limitations of the model. Two points are made in the context of the present study.

The first point refers to the accuracy of multiplier estimates. The results of any social or economic analysis must, by the nature of the data and the techniques of analysis used, be interpreted in a broad accuracy framework. While the mathematical operations of the technique produce results which appear to be precise, a professional assessment of accuracy in general terms is necessary. The accuracy of the estimates in this study as in other studies of this nature, should be interpreted in an 'order of magnitude' holistic framework (Jensen 1980).

The second point refers to the question of the linearity assumption of the input-output model. The notion of linearity is common to most methods of impact analysis, including

most of the alternative methods discussed above. This or some other equally convenient assumption is usually necessary to achieve workable economic models. The main question is not the existence of the assumption but the extent to which it results in unacceptable inaccuracies in empirical work. In this study it was felt that since port-related activity is long-established, and clearly a 'permanent' and integrated part of the regional economy, the linearity assumption posed no problem in the estimation and interpretation of the significance of the industry in the economy of the Barwon region.

Appendix III   Input-Output Sector Definitions

Aggregated Barwon & Victorian input-output table sectors	Corresponding national input-output table sectors [7]
1. Primary	0101 Sheep 0102 Grains 0103 Beef cattle 0104 Dairy cattle 0105 Pigs 0106 Poultry 0107 Other agriculture 0200 Services to agric., hunting & trapping 0300 Forestry and logging 0400 Commercial fishing
2. Mining	1100 Coal; oil and gas 1301 Iron ores 1302 Non-ferrous metal ores 1400 Other mining 1500 Services to mining
3. Manufacturing	2101 Meat & meat products 2102 Dairy products 2103 Fruit and vegetable products 2104 Oils and fats 2105 Flour & cereal foods 2106 Bakery products 2107 Confectionery 2108 Other food products 2109 Soft drinks, cordials and syrups 2110 Beer and malt 2111 Wine & spirits 2112 Tobacco products 2201 Textile fibres, yarns etc. 2202 Textile products 2203 Knitting mill products 2204 Clothing 2205 Footwear 2206 Leather & leather products 2301 Sawmill products 2302 Other wood products 2303 Pulp, paper & paperboard 2305 Paper bags and products 2401 Printing & services to printing 2402 Publishing; recorded media etc.

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[7]   Concordance between the national input-output sectors and ANZSIC sectors can be found in Australian Bureau of Statistics (2001).

Aggregated Barwon & Victorian input-output table sectors	Corresponding national input-output table sectors
3.　　Manufacturing (cont.)	2501 Petroleum & coal products 2502 Basic chemicals 2503 Paints 2504 Pharmaceuticals etc. 2505 Soap & other detergents 2506 Cosmetic & toiletry preparations 2507 Other chemical products 2508 Rubber products 2509 Plastic products 2601 Glass & glass products 2602 Ceramic products 2603 Cement, lime and concrete slurry 2604 Plaster & other concrete products 2605 Other non-metallic mineral products 2701 Iron & steel 2702 Basic non-ferrous metals etc. 2703 Structural metal products 2704 Sheet metal products 2705 Fabricated metal products 2801 Motor vehicles & parts; other t/port equip 2802 Ships and boats 2803 Railway equipment 2804 Aircraft 2805 Photographic & scientific equipment 2806 Electronic equipment 2807 Household appliances 2808 Other electrical equipment 2809 Agricultural, mining etc. machinery 2810 Other machinery & equipment 2901 Prefabricated buildings 2902 Furniture 2903 Other manufacturing
4.　　Utilities	3601 Electricity 3602 Gas 3701 Water, sewerage and drainage
5.　　Building and construction	4101 Residential building 4102 Other construction
6.　　Wholesale and retail trade, etc., trade	4501 Wholesale trade 5101 Retail trade 5401 Mechanical repairs 5402 Other repairs
7.　　Accommodation, cafes & restaurants	5701 Accommodation, cafes & restaurants

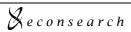| Aggregated Barwon & Victorian input-output table sectors	Corresponding national input-output table sectors
8. Transport (excl Port)	6101 Road transport 6201 Rail, pipeline & other transport 6301 Water transport 6401 Air & space transport 6601 Services to transport; storage
9. Port	This sector is a composite of parts of a number of other sectors including 6601,6101 and 6201.
10. Communication	7101 Communication services
11. Finance, business services	7301 Banking 7302 Non-bank finance 7303 Financial asset investors 7401 Insurance 7501 Services to finance etc. 7702 Other property services 7801 Scientific research, technical and computer services 7802 Legal, accounting etc. 7803 Other business services
12. Ownership of dwellings	7701 Ownership of dwellings
13. Public administration	8101 Government administration (part) 8201 Defence
14. Community services	8601 Health services 8401 Education 8701 Community services
15. Recreation, personal services	9101 Motion picture, radio etc. 9201 Libraries, museums & the arts 9301 Sport, gambling etc. 9501 Personal Services 9601 Other services

Appendix IV   Disaggregated Multipliers - Barwon

Table IV.1 Disaggregated output multipliers for the Port of Geelong, 2004/05 (Barwon)

Sector [a]	Initial	First [b]	Indust. [b]	Total	(%)	Consumption [c]	Total	%
Primary	0.00	0.00	0.00	0.00	0.20	0.01	0.02	0.98
Mining	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.07
Manufacturing	0.00	0.03	0.02	0.05	3.93	0.07	0.12	7.31
Utilities	0.00	0.01	0.00	0.02	1.22	0.01	0.03	1.69
Construction	0.00	0.01	0.00	0.01	1.06	0.00	0.02	0.95
Wholesale and retail trade, etc.	0.00	0.03	0.01	0.05	3.62	0.09	0.14	8.26
Accommodation, restaurants, etc.	0.00	0.00	0.00	0.01	0.57	0.03	0.04	2.15
Transport, storage (excl port)	0.00	0.02	0.01	0.03	2.39	0.01	0.04	2.60
Port	1.00	0.00	0.00	1.00	78.19	0.00	1.00	58.59
Communication	0.00	0.01	0.00	0.02	1.31	0.01	0.03	1.58
Finance, business services	0.00	0.05	0.03	0.08	6.65	0.05	0.14	8.02
Ownership of dwellings	0.00	0.00	0.00	0.00	0.00	0.06	0.06	3.68
Public administration	0.00	0.00	0.00	0.01	0.49	0.00	0.01	0.48
Community services	0.00	0.00	0.00	0.00	0.10	0.03	0.03	1.59
Recreation, personal services	0.00	0.00	0.00	0.00	0.22	0.03	0.04	2.06
Total	1.00	0.19	0.09	1.28	100.00	0.43	1.71	100.00

a. Sector definitions are given in Appendix III.

b. First-round + industrial-support effects = production-induced effects.

c. Consumption refers to consumption-induced effects.

Note Components may not sum to totals due to rounding.

Type I Multiplier	1.28
Type II Multiplier	1.71

Source EconSearch analysis.

Table IV.2 Disaggregated value added multipliers for the Port of Geelong, 2004/05 (Barwon)

Sector [a]	Initial	First [b]	Indust. [b]	Total	(%)	Consumption [c]	Total	%
Primary	0.00	0.00	0.00	0.00	0.14	0.01	0.01	0.68
Mining	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.06
Manufacturing	0.00	0.01	0.01	0.01	2.14	0.02	0.04	4.04
Utilities	0.00	0.01	0.00	0.01	1.25	0.01	0.02	1.72
Construction	0.00	0.01	0.00	0.01	0.95	0.00	0.01	0.84
Wholesale and retail trade, etc.	0.00	0.02	0.01	0.02	3.42	0.05	0.07	7.91
Accommodation, restaurants, etc.	0.00	0.00	0.00	0.00	0.47	0.01	0.02	1.74
Transport, storage (excl port)	0.00	0.01	0.00	0.01	2.08	0.01	0.02	2.23
Port	0.52	0.00	0.00	0.52	80.54	0.00	0.52	59.67
Communication	0.00	0.01	0.00	0.01	1.51	0.01	0.02	1.80
Finance, business services	0.00	0.03	0.01	0.04	6.58	0.03	0.07	7.90
Ownership of dwellings	0.00	0.00	0.00	0.00	0.00	0.05	0.05	6.26
Public administration	0.00	0.00	0.00	0.00	0.49	0.00	0.00	0.49
Community services	0.00	0.00	0.00	0.00	0.16	0.02	0.02	2.53
Recreation, personal services	0.00	0.00	0.00	0.00	0.23	0.02	0.02	2.12
Total	0.52	0.09	0.04	0.65	100.00	0.23	0.87	100.00

a. Sector definitions are given in Appendix III.

b. First-round + industrial-support effects = production-induced effects.

c. Consumption refers to consumption-induced effects.

Note Components may not sum to totals due to rounding.

Type I Multiplier   1.24

Type II Multiplier   1.68

Source EconSearch analysis.

Table IV.3 Disaggregated income multipliers for the Port of Geelong, 2004/05 (Barwon)

Sector [a]	Initial	First [b]	Indust. [b]	Total	(%)	Consumption [c]	Total	%
Primary	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.45
Mining	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.04
Manufacturing	0.00	0.00	0.00	0.01	2.52	0.01	0.02	4.71
Utilities	0.00	0.00	0.00	0.00	0.67	0.00	0.00	0.90
Construction	0.00	0.00	0.00	0.00	0.94	0.00	0.00	0.82
Wholesale and retail trade, etc.	0.00	0.01	0.00	0.01	5.56	0.03	0.05	12.48
Accommodation, restaurants, etc.	0.00	0.00	0.00	0.00	0.64	0.01	0.01	2.33
Transport, storage (excl port)	0.00	0.01	0.00	0.01	2.50	0.00	0.01	2.64
Port	0.20	0.00	0.00	0.20	74.68	0.00	0.20	54.20
Communication	0.00	0.00	0.00	0.00	1.50	0.00	0.01	1.76
Finance, business services	0.00	0.02	0.01	0.02	9.14	0.02	0.04	10.70
Ownership of dwellings	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Public administration	0.00	0.00	0.00	0.00	1.07	0.00	0.00	1.04
Community services	0.00	0.00	0.00	0.00	0.33	0.02	0.02	4.97
Recreation, personal services	0.00	0.00	0.00	0.00	0.33	0.01	0.01	2.99
Total	0.20	0.05	0.02	0.27	100.00		0.10	0.37	100.00

a. Sector definitions are given in Appendix III.

b. First-round + industrial-support effects = production-induced effects.

c. Consumption refers to consumption-induced effects.

Note Components may not sum to totals due to rounding.

Type I Multiplier   1.34

Type II Multiplier   1.85

Source EconSearch analysis.

Table IV.4 Disaggregated employment multipliers[a] for the Port of Geelong, 2004/05 (Barwon)

Sector [b]	Initial	First [c]	Indust. [c]	Total	(%)	Consumption [d]	Total	%
Primary	0.00	0.00	0.01	0.01	0.25	0.06	0.08	1.10
Mining	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.02
Manufacturing	0.00	0.08	0.05	0.14	2.86	0.20	0.34	4.85
Utilities	0.00	0.02	0.01	0.03	0.59	0.02	0.05	0.76
Construction	0.00	0.06	0.00	0.07	1.36	0.01	0.08	1.13
Wholesale and retail trade, etc.	0.00	0.28	0.10	0.37	7.68	0.81	1.18	16.85
Accommodation, restaurants, etc.	0.00	0.03	0.02	0.05	1.01	0.20	0.25	3.52
Transport, storage (excl port)	0.00	0.09	0.02	0.11	2.30	0.05	0.16	2.31
Port	3.58	0.00	0.00	3.58	74.12	0.00	3.58	51.28
Communication	0.00	0.04	0.01	0.05	1.12	0.03	0.09	1.25
Finance, business services	0.00	0.22	0.13	0.35	7.20	0.21	0.56	7.99
Ownership of dwellings	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Public administration	0.00	0.03	0.01	0.04	0.75	0.01	0.05	0.69
Community services	0.00	0.00	0.01	0.01	0.30	0.30	0.31	4.50
Recreation, personal services	0.00	0.01	0.01	0.02	0.43	0.24	0.26	3.73
Total	3.58	0.87	0.39	4.83	100.00	2.15	6.98	100.00

a. Jobs per million dollars.

b. Sector definitions are given in Appendix III.

c. First-round + industrial-support effects = production-induced effects.

d. Consumption refers to consumption-induced effects.

Note Components may not sum to totals due to rounding.

Type I Multiplier   1.35
Type II Multiplier   1.95

Source EconSearch analysis.

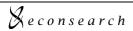# Appendix V Disaggregated Multipliers - Victoria

Table V.1 Disaggregated output multipliers for the Port of Geelong, 2004/05 (Victoria)

Sector [a]	Initial	First [b]	Indust. [b]	Total	(%)	Consumption [c]	Total	%
Primary	0.00	0.00	0.00	0.00	0.14	0.01	0.01	0.57
Mining	0.00	0.00	0.00	0.00	0.20	0.00	0.00	0.25
Manufacturing	0.00	0.04	0.04	0.08	5.66	0.10	0.18	9.26
Utilities	0.00	0.01	0.01	0.02	1.47	0.02	0.04	1.94
Construction	0.00	0.01	0.00	0.02	1.07	0.00	0.02	0.92
Wholesale and retail trade, etc.	0.00	0.05	0.02	0.07	4.91	0.09	0.16	8.29
Accommodation, restaurants, etc.	0.00	0.01	0.00	0.01	0.71	0.03	0.04	1.82
Transport, storage (excl port)	0.00	0.03	0.01	0.04	3.04	0.02	0.06	3.13
Port	1.00	0.00	0.00	1.00	70.18	0.00	1.00	51.83
Communication	0.00	0.02	0.01	0.03	1.86	0.02	0.04	2.33
Finance, business services	0.00	0.07	0.06	0.14	9.67	0.09	0.23	11.79
Ownership of dwellings	0.00	0.00	0.00	0.00	0.00	0.08	0.08	3.95
Public administration	0.00	0.01	0.00	0.01	0.58	0.00	0.01	0.57
Community services	0.00	0.00	0.00	0.00	0.14	0.02	0.03	1.39
Recreation, personal services	0.00	0.00	0.00	0.01	0.36	0.03	0.04	1.94
Total	1.00	0.26	0.17	1.42	100.00	0.50	1.93	100.00

a. Sector definitions are given in Appendix III.

b. First-round + industrial-support effects = production-induced effects.

c. Consumption refers to consumption-induced effects.

Note Components may not sum to totals due to rounding.

Type I Multiplier   1.42

Type II Multiplier   1.93

Source EconSearch analysis.

Table V.2 Disaggregated value added multipliers for the Port of Geelong, 2004/05 (Victoria)

Sector [a]	Initial	First [b]	Indust. [b]	Total	(%)	Consumption [c]	Total	%
Primary	0.00	0.00	0.00	0.00	0.13	0.00	0.01	0.54
Mining	0.00	0.00	0.00	0.00	0.21	0.00	0.00	0.25
Manufacturing	0.00	0.01	0.01	0.02	3.08	0.03	0.05	4.98
Utilities	0.00	0.01	0.00	0.01	1.51	0.01	0.02	1.96
Construction	0.00	0.01	0.00	0.01	1.09	0.00	0.01	0.92
Wholesale and retail trade, etc.	0.00	0.02	0.01	0.03	4.55	0.04	0.08	7.71
Accommodation, restaurants, etc.	0.00	0.00	0.00	0.00	0.56	0.01	0.01	1.43
Transport, storage (excl port)	0.00	0.02	0.01	0.02	3.27	0.01	0.03	3.32
Port	0.52	0.00	0.00	0.52	72.47	0.00	0.52	52.76
Communication	0.00	0.01	0.01	0.02	2.22	0.01	0.03	2.75
Finance, business services	0.00	0.04	0.03	0.07	9.83	0.05	0.12	11.91
Ownership of dwellings	0.00	0.00	0.00	0.00	0.00	0.07	0.07	6.73
Public administration	0.00	0.00	0.00	0.00	0.45	0.00	0.00	0.44
Community services	0.00	0.00	0.00	0.00	0.22	0.02	0.02	2.19
Recreation, personal services	0.00	0.00	0.00	0.00	0.40	0.02	0.02	2.11
Total	0.52	0.12	0.08	0.72	100.00		0.27	0.99	100.00

a. Sector definitions are given in Appendix III.

b. First-round + industrial-support effects = production-induced effects.

c. Consumption refers to consumption-induced effects.

Note Components may not sum to totals due to rounding.

Type I Multiplier	1.38
Type II Multiplier	1.90

Source EconSearch analysis.

Table V.3 Disaggregated income multipliers for the Port of Geelong, 2004/05 (Victoria)

Sector[a]	Initial	First[b]	Indust.[b]	Total	(%)	Consumption[c]	Total	%
Primary	0.00	0.00	0.00	0.00	0.17	0.00	0.00	0.70
Mining	0.00	0.00	0.00	0.00	0.09	0.00	0.00	0.11
Manufacturing	0.00	0.01	0.01	0.01	3.31	0.01	0.02	5.09
Utilities	0.00	0.00	0.00	0.00	0.74	0.00	0.00	0.94
Construction	0.00	0.00	0.00	0.01	1.56	0.00	0.01	1.29
Wholesale and retail trade, etc.	0.00	0.02	0.01	0.03	8.01	0.03	0.06	13.26
Accommodation, restaurants, etc.	0.00	0.00	0.00	0.00	0.79	0.01	0.01	1.97
Transport, storage (excl port)	0.00	0.01	0.00	0.02	4.71	0.01	0.02	4.67
Port	0.20	0.00	0.00	0.20	61.81	0.00	0.20	44.04
Communication	0.00	0.01	0.00	0.01	2.38	0.01	0.01	2.88
Finance, business services	0.00	0.02	0.02	0.05	14.58	0.03	0.08	16.81
Ownership of dwellings	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Public administration	0.00	0.00	0.00	0.00	0.80	0.00	0.00	0.77
Community services	0.00	0.00	0.00	0.00	0.44	0.02	0.02	4.18
Recreation, personal services	0.00	0.00	0.00	0.00	0.61	0.01	0.02	3.29
Total	0.20	0.08	0.05	0.33	100.00		0.13	0.46	100.00

a. Sector definitions are given in Appendix III.

b. First-round + industrial-support effects = production-induced effects.
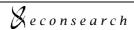
c. Consumption refers to consumption-induced effects.

Note Components may not sum to totals due to rounding.

Type I Multiplier   1.62

Type II Multiplier   2.27

Source EconSearch analysis.

Table V.4 Disaggregated employment multipliers[a] for the Port of Geelong, 2004/05 (Victoria)

Sector[b]	Initial	First[c]	Indust.[c]	Total	(%)	Consumption[d]	Total	%
Primary	0.00	0.00	0.02	0.02	0.27	0.07	0.09	1.09
Mining	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.05
Manufacturing	0.00	0.13	0.11	0.24	4.17	0.28	0.51	6.31
Utilities	0.00	0.02	0.01	0.03	0.57	0.02	0.06	0.70
Construction	0.00	0.09	0.00	0.09	1.66	0.01	0.11	1.33
Wholesale and retail trade, etc.	0.00	0.49	0.15	0.63	11.21	0.88	1.51	18.55
Accommodation, restaurants, etc.	0.00	0.04	0.03	0.08	1.38	0.19	0.27	3.33
Transport, storage (excl port)	0.00	0.13	0.06	0.19	3.29	0.07	0.26	3.17
Port	3.58	0.00	0.00	3.58	63.57	0.00	3.58	43.97
Communication	0.00	0.07	0.03	0.10	1.84	0.07	0.18	2.16
Finance, business services	0.00	0.30	0.28	0.58	10.30	0.36	0.94	11.51
Ownership of dwellings	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Public administration	0.00	0.02	0.01	0.03	0.61	0.01	0.05	0.57
Community services	0.00	0.01	0.02	0.02	0.40	0.28	0.30	3.71
Recreation, personal services	0.00	0.02	0.02	0.04	0.69	0.25	0.29	3.55
Total	3.58	1.31	0.74	5.63	100.00		2.51	8.15	100.00

a. Jobs per million dollars.

b. Sector definitions are given in Appendix III.

c. First-round + industrial-support effects = production-induced effects.

d. Consumption refers to consumption-induced effects.

Note Components may not sum to totals due to rounding.

Type I Multiplier   1.57

Type II Multiplier   2.27

Source EconSearch analysis.

Glossary

Consumption-induced effects are additional output, employment and income resulting from re-spending by households that receive income from employment in direct and indirect activities. Consumption-induced effects are sometimes referred to as "induced effects".

Direct effects are the initial round of output, employment and income generated by an economic activity.

Employment is the number of working proprietors, managers, directors and other employees, in terms of the number of full-time equivalent jobs.

Flow-on effects are the sum of the production-induced effects and the consumption-induced effects.

Gross regional product (at factor cost) is a measure of value added on a regional basis. It can be calculated using two methods. The income method calculates GRP as household income plus other value added. The expenditure method calculates GRP as household expenditure plus other final demand, that is, in total, gross regional expenditure, plus exports less imports.

Household income is wages and salaries and other payments to labour including overtime payments and income tax, but excluding payroll tax.

Input-output analysis is an accounting system of inter-industry transactions based on the notion that no industry exists in isolation.

Input-output table is a transactions table that illustrates and quantifies the purchases and sales of goods and services taking place in an economy at a given point in time. It provides a numerical picture of the size and shape of the economy and its essential features. Each item is shown as a purchase by one sector and a sale by another, thus constructing two sides of a double accounting schedule.

Multiplier is an index (ratio) indicating the overall change in the level of activity that results from an initial change in economic activity. They are an indication of the strength of the linkages between a particular sector and the rest of the regional economy. They can be used to estimate the impact of a change in that particular sector on the rest of the economy. See Table 4.1 for a description of multiplier components.

Output is gross revenue of goods and services produced by commercial organisations plus gross expenditure by government agencies.

Production-induced effects are additional output employment and income resulting from re-spending by firms that receive income from the sale of goods and services to firms undertaking, for example, agricultural activities. Production-induced effects are sometimes referred to as "indirect effects".
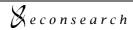
Total impact is the sum of the direct effects and the flow-on effects.

Type I multiplier is calculated as (direct effects + production induced effects)/direct effects.

Type II multiplier is calculated as (direct effects + production induced effects + consumption induced effects)/direct effects.

Value added is calculated as the value of output less the cost of goods and services (including imports) used in producing the output. It represents payments to the primary inputs of production (labour, capital and land). Value added is consistent with standard measures of economic activity, such as gross domestic, state or regional product, and it provides an assessment of the net contribution to regional economic growth of a particular enterprise or activity.

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