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PRODUCTIVITY COMMISSION

International Benchmarking of Container Stevedoring

Commission Research Paper

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The Productivity Commission

The Productivity Commission, an independent Commonwealth agency, is the Government's principal review and advisory body on microeconomic policy and regulation. It conducts public inquiries and research into a broad range of economic and social issues affecting the welfare of Australians.

The Commission's independence is underpinned by an Act of Parliament. Its processes and outputs are open to public scrutiny and are driven by concern for the wellbeing of the community as a whole.

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Foreword

International benchmarking of key infrastructure industries provides information to judge whether services that are essential to the performance of the Australian economy are being supplied efficiently.

This study updates aspects of the Commission's 1998 study on *International Benchmarking of the Australian Waterfront*, which was based on data collected throughout 1997. The present study draws on data collected mainly during the 2002 calendar year for the same selection of ports.

The key challenge in any benchmarking exercise, particularly at the international level, is to achieve like-with-like comparisons. This study has sought to avoid one major potential source of difference by essentially following the same ships from port to port. As a consequence, the results would be expected to differ from more complete domestic surveys intended to assess trends at Australian ports alone.

While there is some variation across trades, it seems clear from the information in this study that Australian ports have generally made substantial progress between 1997 and 2002 in closing the performance gap with overseas ports.

The study was prepared within the Economic Infrastructure Branch under the supervision of Chris Sayers. Data collection was undertaken by New Zealand shipping and port consultants AmZ Limited. The research team and AmZ were assisted by many shipping lines, organisations and individuals in gathering information for the study. The Commission is grateful for their cooperation and their time. The Commission is also grateful for helpful feedback on a draft version of this report from the Bureau of Transport and Regional Economics, as well as terminal operators and Shipping Australia.

Gary Banks
Chairman

July 2003

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Appendixes

Key points

- The productivity at Australian container terminals, as measured by Net Crane Rates, has improved significantly in absolute terms since 1997.
- For the sample of ship calls and terminals studied by the Commission, productivity improved also in relative terms, with the productivity improvement at Australian terminals generally greater than at overseas terminals between 1997 and 2002.
- As a consequence, there was an appreciable reduction in the overall productivity gap between Australian terminals and those at the overseas ports included in the study
  - this has been achieved despite inherent disadvantages related to generally smaller trade volumes and throughput at Australian terminals.
- In 1997, container handling charges at Australian terminals were higher than those at most of the overseas terminals included in the study. Although still true, by 2002, the gap had been reduced, except for Nagoya and those sampled in the US.
- Notwithstanding the productivity improvements since 1997, there may be scope for further gains in the relative performance of Australian terminals. For example, Tauranga terminal in New Zealand has been able to deliver higher productivity and lower charges than its Australian counterparts, with similar or lower throughput.

1 Introduction

Efficient container handling at low cost to importers and exporters is important to Australia's economic performance. Poor performance on the waterfront adversely affects the competitiveness of Australian exports. It also imposes higher costs on Australian manufacturers and individual consumers of imported goods.

In 1998, the Productivity Commission published an international benchmarking study of the Australian waterfront, using data collected in 1997. In the study (PC 1998a), the Commission presented comparisons of container terminal handling rates (container lifts per hour) and charges at the Australian and overseas container terminals visited by ships operating in Australia's container trades.

The Commission has re-examined container terminal handling rates for 2002 in order to investigate whether the performance of Australian terminals has improved relative to the performance of overseas terminals. To this end, international differences in container terminal handling rates and charges in 2002 were compared with those collected in 1997 for the earlier study.

1.1 Study approach

The approach used in the 1998 study to collect data on relative container terminal performance was also adopted in this study. A key aspect of the approach was to collect data from ship owners rather than terminal operators, in order to facilitate the collection of internationally comparable information.

Many of the lines providing services and the ships they use have changed in the period between 1997 and 2002. The advantage of comparing relative performance at a particular point in time is that the consequences of unavoidable departures from like-with-like comparisons are smaller than for comparisons of absolute changes in performance over time.

The performance measures used were crane handling rates (container lifts per hour) and container handling charges. These measures were selected because they are understood and accepted by industry participants. Also, they are collected and published for Australian ports, by the Bureau of Transport and Regional Economics (BTRE) and the Australian Competition and Consumer Commission (ACCC).

Data for crane handling rates and container handling charges were compared on a trade basis for the same ships calling at the ports on each trade. Different size ships tend to be used on different (shipping) trades. All other things being equal, newer and larger ships lend themselves to faster crane working rates.

With the Commission's ship tracking approach, the effects of a key external variable affecting container handling rates — the type of ship used — are significantly reduced in the comparisons. Although the sample of ship calls used to analyse a particular trade may be drawn from more than one line, the ships used by the lines are generally similar.[1]

This ship tracking approach to obtaining comparable international data differs to that taken by the BTRE in its *Waterline* publication. The BTRE, which focuses solely on domestic performance, publishes data on a port basis by aggregating information for container ships of all sizes visiting each of Australia's major container ports.

Prior to publication, the Commission sent a draft of this report for comment to the BTRE, Shipping Australia, P&O Ports, Patrick Terminals and CSX Terminals.

1.2 Scope

With two exceptions, data were collected for ships operating in the same trades and visiting the same ports as in the 1998 study (PC 1998a). Tauranga was added as an additional port on the Australia to New Zealand trade for 2002 and Adelaide was added for the Europe trade. In all, data were collected for ships operating during 2002 on 5 trades, calling at 16 ports (see table 1.1).

Handling charges were collected for ordinary and 'reefer' (refrigerated) shipping containers. Charges for ordinary containers cover loading and unloading shipping containers from ship to shore, including transfers to and from road and rail vehicles.

In the case of refrigerated containers, there are charges for connecting and supplying electricity, as well as monitoring temperature and power consumed. These charges are additional to the loading or unloading charge. They are known as 'reefer charges' and are reported separately.

1 For some ports, data has been collected for more than one terminal operator, in which case the average for that port will be influenced by the terminals used by the shipping lines visiting that port, as well as performance differences among terminals at that port.

Table 1.1 **Trades and ports used for benchmarking, 2002**

Trade	*Ports*						
United States	Melbourne	Sydney	Brisbane	Los Angeles	Philadelphia		
Europe	Fremantle	Adelaide	Melbourne	Sydney	Hamburg	Tilbury	
SE Asia	Fremantle	Adelaide	Melbourne	Sydney	Brisbane	Singapore	Port Klang
East Asia	Melbourne	Sydney	Brisbane	Pusan	Nagoya		
New Zealand	Melbourne	Sydney	Tauranga	Auckland	Lyttelton		

The size of the sample is larger than that for the 1998 study (PC 1998a). Details of the sample sizes for container handling charges and handling rates, are contained in chapters 3 and 4 respectively. The selected shipping lines handle about 70 per cent of all containers into and out of Australia (AmZ 2003).

Information on certain operational features of the container terminals included in the study was also collected, and is reported in chapter 4. This information includes measures of container handling equipment, port infrastructure and manpower utilisation.

1.3 Data collection

The Productivity Commission engaged a consultant with specialised knowledge of terminal operations (New Zealand shipping and port consultant, AmZ Ltd) to collect the information on international container handling rates and charges. AmZ collected these data from shipping lines. Some of the information in section 4.2 — on labour and infrastructure utilisation — was collected from container terminals. The data collected and used to generate the diagrams in this report, are reproduced in appendix A.

AmZ noted in its report that since the 1998 study, there had been several changes to the shipping lines servicing Australia:

> The lines have remained almost the same but the consortia in which they operate and the weighting of individual lines within a consortium have changed considerably. In other instances, lines have merged or rationalised within a common ownership group and the type of tonnage deployed has changed (AmZ 2003).

AmZ selected a group of shipping line operators within each trade from which to collect data. The consultants developed a questionnaire and addressed individual letters to the CEOs of the shipping lines requesting their participation. The requests were supported by an explanatory letter from the Chairman of the Productivity Commission and a letter of endorsement from Shipping Australia.

Seven shipping lines were approached. The initial response was positive, with all lines agreeing to participate.

The lines were requested by AmZ to provide data for ships that transited the selected ports on at least three successive voyages during the 12 months commencing 1 June 2001. Given the voyage times in some trades, charges and productivity data are for a period spanning much of the 2002 calendar year.

The data was provided to AmZ in different formats. Where adjustments were necessary to ensure data consistency, AmZ made contact with the shipping lines to ensure that its understanding of the shipping line's data was correct and that the changes were appropriate.

Once the shipping lines and trades had been selected for the study, the ports of call and container terminals used could also be identified. Data were sought from the terminals used by the ships in the sample to try and identify characteristics of the terminals that might have a bearing on the container handling performance reported by the shipping lines. In some cases, data on equipment and manpower utilisation were collected from terminal and port websites.

AmZ reported that of 17 non-Australian terminals asked to participate, 9 provided information (AmZ 2003). For some ports, the data collected relate to multiple shipping lines and more than one terminal. Where this was the case, AmZ assumed that the same methodology for recording productivity data was used by each of the selected shipping lines.

Shipping lines typically operate on an international basis and use the same format and definitions for recording data, regardless of which country their ships visit. The data collected are therefore consistent for the comparison of relative performance across countries.

According to AmZ, the lines reported no extraordinary delays due to unusual events such as strikes, undue congestion or major equipment failure. Some delays or equipment failures may nevertheless have occurred without being reported, because the ship left the terminal on schedule.

1.4 Benchmarking limitations

The basic challenge in all benchmarking studies is to ensure like-with-like comparisons. As a rule, performance comparisons over time for a particular business are likely to be more robust than comparisons across businesses. This is for two main reasons. First, the features of the operating environment are more likely to differ across businesses, especially internationally. Second, the data are less likely to be collected in a consistent way.

The techniques used to ensure like-with-like comparisons, such as tracking particular ships, are identified in the relevant chapters. Any unavoidable limitations are discussed in terms of their expected effect on comparability.

Container handling charge relativities are affected by fluctuations in the market exchange rates. The rates used by AmZ to convert overseas handling charges to a common currency (Australian dollars) are listed in table 1.2.[2]

Table 1.2 **Market exchange rates — countries in study, November 2002[a]**

Currency	*One A$ equals*
United States (dollar)	0.5595
Euro	0.5611
United Kingdom (pound)	0.3578
Singapore (dollar)	0.9864
Malaysia (ringgit)	2.1261
Japan (yen)	63.3500
South Korea (won)	685.8350
New Zealand (dollar)	1.1372

a Rates as at 1 November 2002.

Source: www.x-rates.com.

The container handling rates used for this study are not measures of economic efficiency. They are a partial measure of technical efficiency, reflecting the application of labour and capital resources. They do not indicate whether handling rates are being achieved using the most economically efficient mix of these resources, given their relative costs.

2 Purchasing Power Parity (PPP) exchange rates were not used in this case because PPPs apply to final consumption prices paid by consumers and are inappropriate for use in comparing intermediate input prices.

1.5 Report structure

Trends in container handling productivity and charges since 1997, together with a description of industry reform initiatives before and after 1998, are outlined in chapter 2.

Container handling charges at Australian and selected overseas terminals are compared in chapter 3. The comparisons of container handling productivity measures are presented in chapter 4.

2 Container stevedoring

Containers are used to transport most international non-bulk cargo. They are transported on specialised ships that are loaded and unloaded at specialised terminals.

Container terminals comprise a yard in which to stack containers, handling equipment such as straddle carriers, rubber-tyred gantries and forklifts to transport and stack containers, and shore-based cranes to lift them on and off ships. The containers usually arrive at and leave the terminal by road or rail transport.

Low productivity and cargo delays at Australian container terminals have been of major concern in the past (PC 1998a, 1998b), given the potential impacts on trade competitiveness and economic performance generally.

In 1998, there was a prolonged dispute between Patrick Stevedores and the Maritime Union of Australia. The subsequent workplace reform package that emerged from this dispute produced higher container handling rates and an improvement in the efficiency of Australia's ports.

2.1 Australia's place in world stevedoring

In aggregate, Australia's container terminals handle over 3 million Twenty Foot Equivalent containers (TEUs) annually. With an average charge of over $160 per TEU (ACCC 2002), the cost of handling these containers in 2002 was about $500 million.

In 1999-2000, the total value of Australia's imports arriving by sea was $76 billion, of which $48 billion arrived on container ships (BTRE 2002a). A further $31 billion worth of goods were exported on container ships.

Container terminals in Australia generally have smaller volumes of throughput than the rest of the world. Australia's five main container ports are Melbourne, Sydney, Brisbane, Adelaide and Fremantle. Of these ports, Melbourne handles the largest volume of containers. Nevertheless, Melbourne only ranks as number 43 in terms of world container traffic — well behind half of the overseas ports in this study (see table 2.1).

Table 2.1 **World port ranking — selected ports, 2000**

Container traffic (TEUs) per year

Rank	*Port*	*Country*	*TEUs*
2	Singapore	Singapore	17 040 000
3	Pusan	South Korea	7 540 387
7	Los Angeles	United States	4 879 429
9	Hamburg	Germany	4 248 247
11	Port Klang	Malaysia	3 206 753
29	Nagoya	Japan	1 564 724
43	Melbourne	Australia	1 273 352

Note World ranking can be based on tonnage or TEUs as the unit of measurement. On a tonnage basis, Singapore would have ranked first. However, Hong Kong's container traffic amounted to 18 100 000 TEUs in 2000 — slightly ahead of Singapore.

Source: Containerisation International Yearbook 2002.

Only one or two stevedoring companies operate at each of Australia's five major ports.[1] Patrick and P&O Ports are the two main terminal operators, both companies being represented at most of Australia's container ports.

2.2 Pre-1998 reforms

There was a drastic reduction in the requirement for waterfront labour following containerisation in the 1960s. This resulted in the number of waterside workers falling from 20 000 in the 1960s to 6000 in 1986 (BTE 1986). Notwithstanding this reduction, the Inter-State Commission concluded in an inquiry conducted between 1986 and 1989 that there was an over abundance of ageing labour, that work arrangements were acting as a barrier to skills development, and that numbers needed to be reduced further.

In 1989, the Commonwealth Government responded to the Inter-State Commission's recommendations by announcing a three-year program to reform the stevedoring industry. The reforms were implemented under the terms of an In-Principle Agreement (IPA) negotiated between the Australian Council of Trade Unions (ACTU), stevedoring employers, stevedoring unions and the government (under the auspices of the Waterfront Industry Reform Authority (WIRA)).

The IPA involved a move from industry-based to company employment, and the creation of career structures in the industry with suitable training and incentive arrangements. The size of the workforce was to be reduced through voluntary

1 A third operator at Brisbane recently withdrew.

redundancies, and the age distribution of the workforce was changed by recruitment of younger workers.

Through a combination of redundancy and recruitment, the WIRA helped to facilitate a smaller and younger workforce. A 57 per cent reduction in the size of the workforce was achieved (BTCE 1995).

2.3 The 1998 reform package

The Productivity Commission reported in 1998, that container handling rates at Australia's container terminals were well below those at selected overseas terminals (PC 1998a). A companion study concluded that work arrangements played a significant role in Australia's relatively poor performance (PC 1998b).

On 8 April 1998, the Commonwealth Government announced a reform package designed to achieve further necessary improvements in efficiency on the Australian waterfront. The package identified seven objectives:

- an end to over-manning and restrictive work practices;
- higher productivity (the goal being a five port average Net Crane Rate of 25 container movements per hour);
- greater reliability through less industrial action and elimination of disruptive work practices;
- an improved safety performance;
- lower costs across the waterfront logistics chain;
- full and effective use of existing and new technology; and
- improved training (ANAO 2000).

The package included an agreement by the Commonwealth Government to lend stevedoring companies the funds necessary to enable them to restructure their workforces by offering voluntary redundancies. These arrangements funded around 1530 redundancies, involving a total outlay of $181 million paid between August 1998 and December 1999 (ANAO 2000).

As part of the reform package, the Commonwealth Government established levy arrangements to repay a loan that was advanced for redundancy payments. The levy is payable by Australian stevedores at the rate of $12 per container — equal to about 7.5 per cent of Australian stevedoring charges.[2]

The levy came into effect on 1 February 1999 and it is anticipated that it will be collected for up to 10 or 12 years, depending on the level of authorised payments and the rate of growth in leviable cargo operations. Over the 10 to 12 year period, it is anticipated that the levy will raise sufficient revenue to fully repay the funds lent by the Commonwealth Government through its wholly-owned agent, the Maritime Industry Finance Company (MIFCo).

As a result of the redundancies arising from the 1998 reform package and the introduction of new technology, the stevedoring workforce is now estimated to have declined to about 1200 today. Accompanying this reduction were significant changes in the terms of employment.

2.4 Developments since 1998

Since April 1998, there have been significant changes in work arrangements at Australia's container terminals and substantial productivity gains.

Enterprise employment

Workplace flexibility was improved under the framework provided by the *Workplace Relations Act 1996*. This was achieved by a move away from industry-wide employment negotiations, to negotiation of employment agreements at the enterprise level.

A major issue in negotiating these agreements was the flexibility of employers to allocate permanent and non-permanent staff to 'top up' labour requirements when needed. The issue arose because variability in labour demand is particularly pronounced, due to the relatively small and infrequent flow of container traffic at Australian ports.

The major stevedoring companies now have enterprise agreements in place that allow greater flexibility in the deployment of labour to accommodate variability in the demand for stevedoring services. The type of flexibility measures sought by stevedoring companies were described and analysed in the Productivity Commission's report on waterfront labour arrangements (PC 1998b).

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2 The levy is subsumed in the charges compared in this report. Patrick Terminals and P&O Ports committed to absorb the cost of the levy within their existing charging. The ACCC regularly reviews that this is the case on behalf of the government.

The Commission noted in its 1997-98 Annual Report that the *Patrick Terminals Enterprise Agreement 1998*, embodied a range of changes to work arrangements that largely addressed the restrictive arrangements previously identified by the Commission (see box 2.1).

Box 2.1 **Container stevedoring work arrangements**

The Commission's report on work arrangements in container stevedoring, released in April 1998, found that despite some improvements in recent years, container stevedoring in Australia had been characterised by a system of complex, inflexible and prescriptive work arrangements which constrained workplace performance. It identified a range of work arrangements that acted to inhibit productivity, reduce timeliness and reliability and increase labour costs for a given level of activity (PC 1998b).

Following extensive negotiations between Patrick Stevedores Holdings Pty Ltd and the Maritime Union of Australia, the *Patrick Terminals Enterprise Agreement 1998* came into force for three years from 1 September 1998.

The Agreement addressed the significant work arrangement issues identified in the Productivity Commission's study.

Order of engagement (or 'pick')	Constraints on the order in which different types of employees are engaged were removed for most shifts.
Relatively high shift premiums and penalties	Premiums and penalties for rostered shifts rolled into an aggregate wage; significantly reduced opportunities to work overtime and especially 'double header' shifts.
Relatively high redundancy provisions	Early Retirement and Redundancy Agreement to be terminated on 1 November 1999.
Prescribed workforce size and composition	Significant management discretion over manning levels; permanent manning reduced by approximately 600.
Equalisation schemes	Eliminated.
Rostering arrangements	Selection and allocation of shifts to be determined by management; introduction of flexible, irregular rostered shifts.
Relatively high leave and rostered time off provisions	Average 40 hour week; Award annual leave retained; rostered time off reduced.
Minimum call-up time and idle time	Likely to be reduced.
Productivity schemes	Minimum payable threshold lift increased.
Constraints on outsourcing	Maintenance, relocation of equipment, security and main gate, cleaning, and linemarking contracted out.

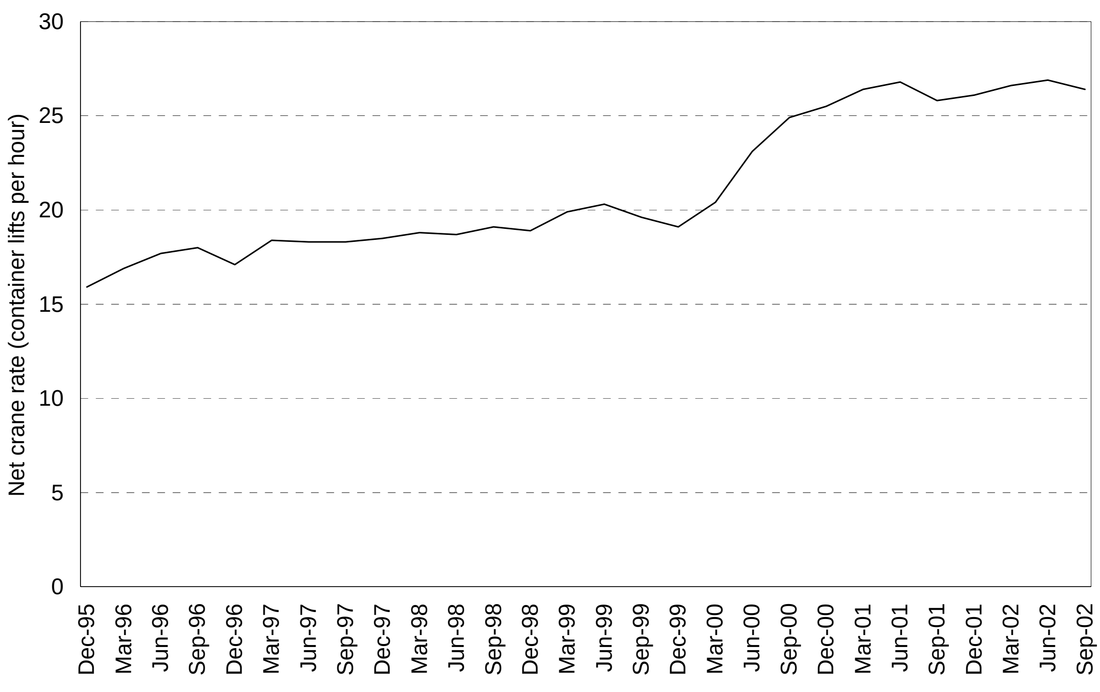
Source: Productivity Commission, Annual Report 1997-98, p. 74.

Productivity gains

Container handling productivity is reported quarterly by the Bureau of Transport and Regional Economics (BTRE) in its *Waterline* publication and is seen to have improved markedly since 1998. The Net Crane Rate — the total containers handled divided by the time that cranes were working (see appendix B for definition) — has increased markedly (see figure 2.1). The BTRE reported in the March 2001 issue of *Waterline*, that the average Net Crane Rate for terminals at Australia's five main container ports, exceeded the 25 containers per hour target rate for the first time in the December quarter 2000.

The reported improvement in productivity occurred during a period of falling workforce numbers and growing container volumes. For example, 'the number of workers at Patrick's three east coast terminals declined from 634 at the beginning of 1998 to 464 in 2001' (RIRDC 2002). Over the same period, the total number of containers handled at Australia's five main ports increased by 19 per cent, from 1.80 million in 1998 to 2.14 million in 2001 (*Waterline*).

Figure 2.1 **Net Crane Rate — Australian ports, December 1995 to September 2002**



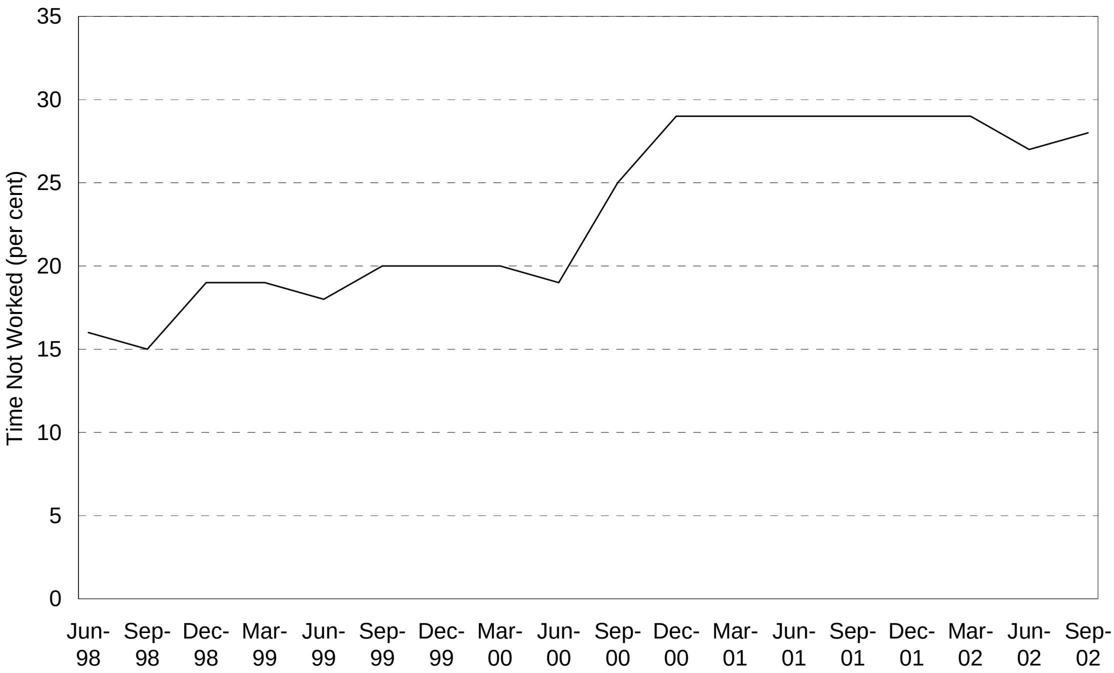
Note Data is based on a weighted average for terminals at Australia's five main container ports: Brisbane, Sydney, Melbourne, Adelaide, Fremantle.

Data source: BTCE, BTRE, *Waterline*, various issues.

It should be noted that crane delays, reported as 'Time Not Worked' in *Waterline*, have increased significantly since 1998 and particularly during 2000 (see figure 2.2).[3] The delays are deducted from the measured time that cranes are working, to produce the Net Crane Rate.

There are many causes of delays as listed under the definition of Elapsed Crane Time (see appendix B).

Figure 2.2 **Time Not Worked (crane delays) — Australia's five main container port average, June 1998 to September 2002**



Note Prior to September 1999, the data is for the average of four main ports, because Time Not Worked data were unavailable for Fremantle in that period.

Data source: BTRE *Waterline*, various issues.

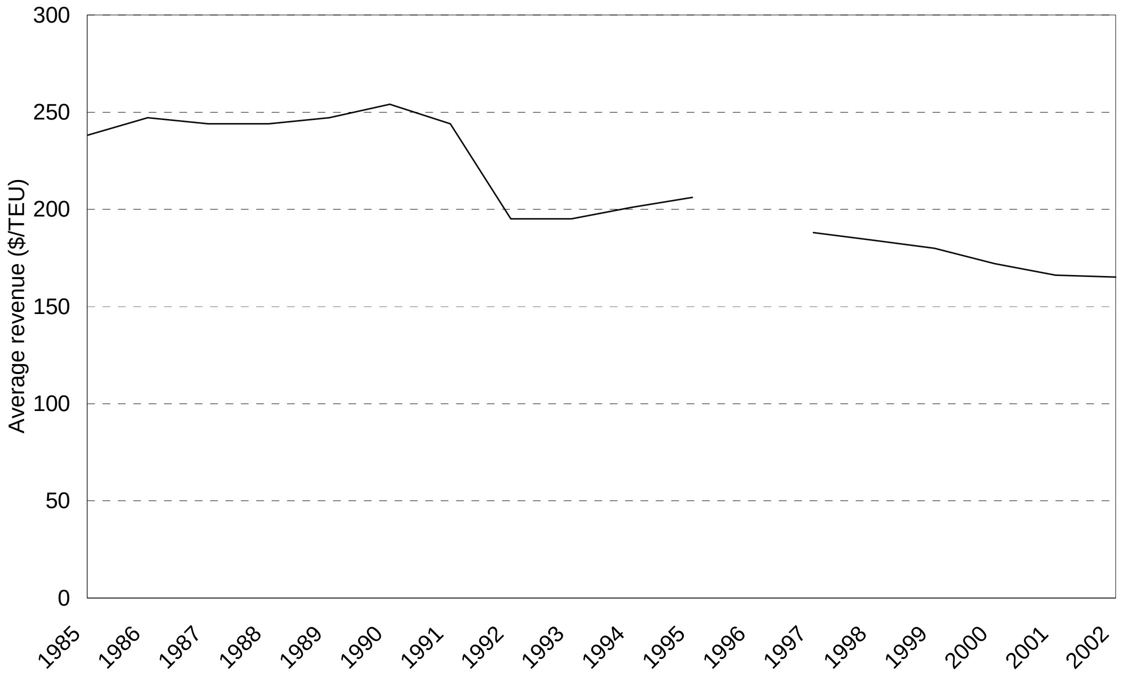
Handling charges

The Australian Competition and Consumer Commission (ACCC) and its predecessor, the Prices Surveillance Authority (PSA), have reported that container handling charges (expressed as average revenue per TEU) have been falling in nominal terms for many years.

3 The BTRE is investigating this issue further and preliminary indications are that the increase in Time Not Worked may be due to a number of factors including more detailed definitions.

Some of the reduction to average revenue is attributable to a change in the composition of containers. The proportion of 40 foot containers — counted as two TEUs — has been increasing. This has the effect of increasing the number of TEUs and reducing average revenue per TEU.

Figure 2.3 **Average revenue — Australian stevedores,1985 to 2002**



Note Data were unavailable for 1996 and apply to part years thereafter. Average revenue is in nominal dollars for each reported year.

Data source: Derived from ACCC, '*Container Stevedoring*', Report no. 4, December 2002.

Role of technology

Effective use of technology was one of the seven objectives identified as part of the 1998 waterfront reforms. The introduction of new technology has gone hand in hand with the introduction of the labour reforms described above.

Some features of these technological improvements were described in a recent report published by the Rural Industries Research and Development Corporation:

> Technological improvements on the waterfront have included new cranes and container handling equipment, and improved management and planning software and systems. Port and transport authorities have made substantial investments to increase port capacity, improve access, and speed the throughput of containers.
>
> Widespread introduction of Vehicle Booking Systems has substantially reduced truck queuing at terminals — in the process eliminating demurrage charges to shippers.

> Greater use of rail access, particularly in Sydney, has also been crucial in reducing congestion.
>
> There have been great strides also in the use of electronic data interchange (EDI). Use of EDI has now clearly reached critical mass — bringing substantial benefits in timeliness and reliability, availability of information, reduction in error, and in avoidance of unnecessary repetition of data entry (RIRDC 2002).

In the RIRDC report, it was concluded that technological innovation at Australian terminals was at an advanced stage relative to selected overseas ports. It found that since 1997, improvements in Net Crane Rates at Brisbane, Melbourne and Sydney, were due both to labour reforms and the influence of new technology. However, it was not possible to determine how much of the improvement was due to one or the other factor.

Timeliness and reliability

There is anecdotal evidence that the reliability of container terminals in turning around ships and cargo has improved. Commenting favourably on improvements in Australia's waterfront performance since 1998, Richard Hein, CEO of P&O Ports, said:

> We, certainly as far as P&O Ports is concerned, are seeing ships sail on their windows and this has never historically happened. If a ship comes in on its window and is sailing on its window, which means ships are meeting their schedules, that's a considerable cost saving to ship owners (Hein 2000).

A number of reliability indicators are reported in *Waterline*. They include waiting time that is attributable to the unavailability of berth, pilot and towage services at the scheduled or confirmed time. A separate category records waiting time attributable to other factors. However, notwithstanding the alleged improvement in sailing times, the reliability trends published in *Waterline* are somewhat inconclusive.

Productivity gains in other countries

Container terminals in other countries could be expected to have also achieved some productivity gains since 1997 — the year when the data were collected for the last benchmarking study. At the very least, new technology would have been introduced in some terminals. The main purpose of this study is to examine whether the previous marked performance gap between Australian and overseas terminals that existed in 1997 has reduced.

3 Container handling charges

The cost of moving a container from one country to another includes the ‘blue water’ freight rate as well as the container handling charge (loading and unloading). Other direct costs include charges for the use of port facilities, transportation, insurance and documentation. The time taken and the reliability of shipping services have indirect effects on inventory costs and perceptions of Australia as a trading partner.

The container handling charge depends, among other things, on the productivity of stevedores and the level of competition in the market.

3.1 Definitions and measurement issues

Generally, container terminals are commercially separate from shipping lines. Container terminal operators compete for business from the shipping lines, on the basis of their container handling charges and also the service they provide in turning ships around.

Container terminal operators normally deal directly with the shipping line. As a consequence of this traditional arrangement, the shipper or cargo owner may not see the container handling charge as a separately identified cost item. The container handling charge is normally passed on in the combined freight plus container handling bill from the shipping line. The container handling charges reported in this chapter are those actually paid by the shipping lines.

Terminal operators charge a higher amount for handling a ‘reefer’ or refrigerated container. This higher charge covers plugging and unplugging refrigerated containers into power, or attaching fixed or portable refrigeration units, as well as the cost of monitoring temperatures and the power consumed.

To some extent, reefer charges reflect costs beyond the terminal gate, such as electricity costs. However, the terminal operator has a degree of control over connect, disconnect and monitoring costs.

Australian container terminal operators usually charge a shipping line the same amount for container handling across all of the Australian ports. A possible reason for this practice is ship operator preference to contract all of their container handling services in Australia from a single operator. However, charges can differ between shipping lines and hence the charges in this chapter vary somewhat between Australian ports.

Generally, there are no differential charges for 20 and 40 foot containers. However, in those trades where charges differ for 20 foot and 40 foot containers, the charge to lift a 40 foot container is not twice that to lift a 20 foot container.[1] Where charges do differ, a cargo weighted average for 20 and 40 foot containers was calculated (as in the 1998 study).

The charges — measured as dollars per Twenty Foot Equivalent Unit (TEU) — were expressed as index values in the 1998 study to remove any commercial confidentiality concerns. A similar approach has been adopted for the international comparisons in 2002.

All 2002 data are reported with the index base equal to 100 for Sydney. Where charges in 1997 are compared with those in 2002, the 1997 nominal charges were indexed with the index base equal to 100 for Sydney in 2002.

For all of the Australian terminals, 1997 nominal charges (and hence the index values) were higher than in 2002, so that the fall in real charges has been even greater. This also applies for a number of the overseas terminals in the study.

Between 1997 and 2002, a $12 per container levy was introduced to repay a loan for redundancy payments (see chapter 2). The ACCC has determined that this levy has not been passed on in the form of higher container-handling charges (ACCC 2002). However, it is expected that the levy will be removed in several years time (see chapter 2) and, all other things being equal, container handling charges could be expected to fall further as a result.

3.2 Comparisons

In 1998, the Commission reported that Australian container handling charges were significantly higher than those in overseas ports. The one exception was Nagoya on the East Asia trade, which had the highest container handling charge for that trade.

Container handling charges appear to have fallen in Australia since then, although the apparent decline in charges, has been influenced by the change in the

1 A 40 foot container equals two 20 foot equivalents or TEUs.

composition of containers and the way the charges are measured in terms of TEUs by the ACCC (see chapter 2).

The 2002 container handling charges for overseas ports reported in this chapter were converted to Australian dollars using the exchange rates in table 1.2 in chapter 1.[2] The 1997 charges were converted to Australian dollars using market exchange rates prevailing at that time (PC 1998a).

Changes in exchange rate relativities over the period from 1997 to 2002 will have had some impact on the price comparisons reported in Australian dollars (see below for example of US exchange rate effect on container handling charges at Los Angeles).

AmZ collected information on container handling charges from a number of shipping lines operating on each trade (see table 3.1). Where there were data for more than one line at a port, an arithmetic average of the charges levied by each of the sampled lines visiting that port was calculated.

AmZ also collected data on reefer (refrigerated) container handling charges for all trades in the study. Some terminals provide reefer services for a minimum or maximum period for example, five days minimum. Alternatively, shipping lines can be charged on a daily basis. Because of these and other differences in charging practices, AmZ collected, wherever possible, reefer charges for five days and calculated a one-day average for benchmarking purposes.

The data for all figures in this chapter are reproduced in appendix A. The index values in all figures are derived from data on charges per TEU.

2 Purchasing Power Parity (PPP) exchange rates were not used because they apply to final consumption prices and are inappropriate for use in comparing intermediate input prices.

Table 3.1 **Number of lines sampled — by port, 2002**

Trade/Ports	*US West Coast*	*US East Coast*	*Europe*	*SE Asia*	*East Asia*	*New Zealand*
Fremantle			3	4	2	
Adelaide			3	2		
Melbourne	4	3	3	3	4	4
Sydney	4	3	3	3	3	4
Brisbane	1	3		2	3	2
Los Angeles	4					
Philadelphia		3				
Hamburg			2			
Tilbury			2			
Singapore				3		
Port Klang				2		
Nagoya					3	
Pusan					3	
Auckland						4
Tauranga						3
Lyttelton						2

Source: AmZ 2003.

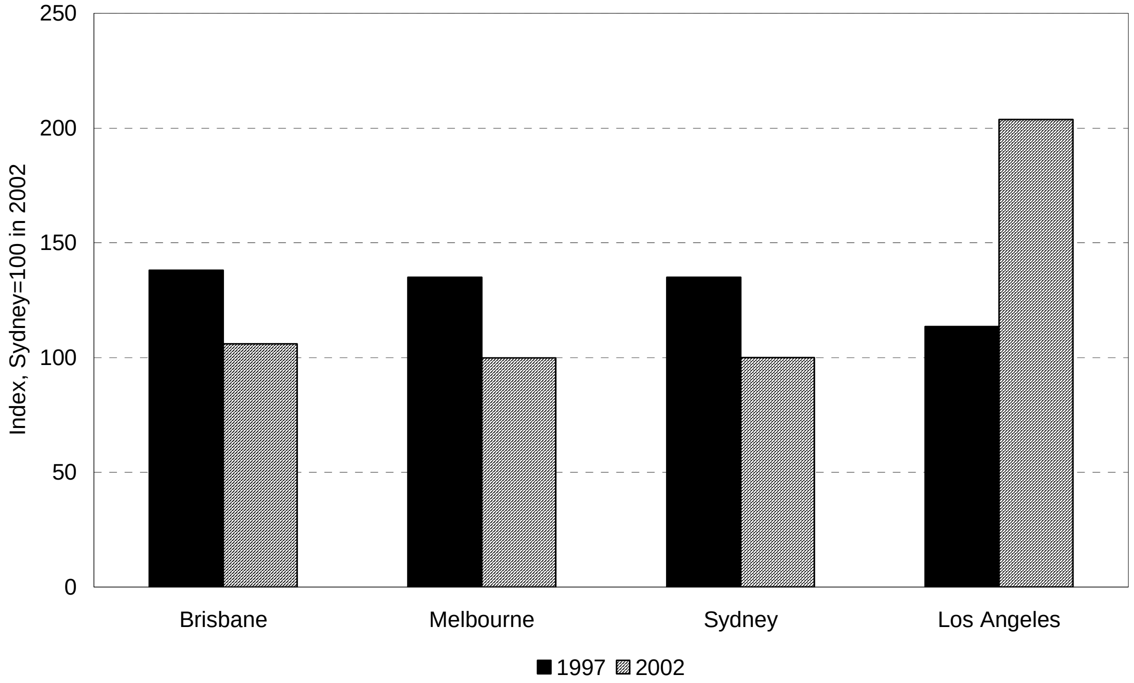
US West Coast trade

The container handling charges collected for ships operating in the US West Coast trade in 1997 and 2002 are presented in figure 3.1. In 2002, charges in Los Angeles were substantially higher than at Australian terminals, although this relativity is shown in Australian dollars and is therefore influenced by exchange rate changes.

For Los Angeles, approximately half of the 80 per cent increase in the nominal charge relativity since 1997, as shown by the index values in figure 3.1, was due to the change in the exchange rate from $US0.77 to the Australian dollar in 1997 to $US0.56 in November 2002. If the exchange rate in 2002 had remained at its 1997 level, then the charges in 2002 for Los Angeles would have converted to fewer Australian dollars and the increase would have been less than 40 per cent in nominal terms.

Figure 3.1 **Relative container handling charges — US West Coast trade, 1997 and 2002**

Charges in nominal terms per TEU

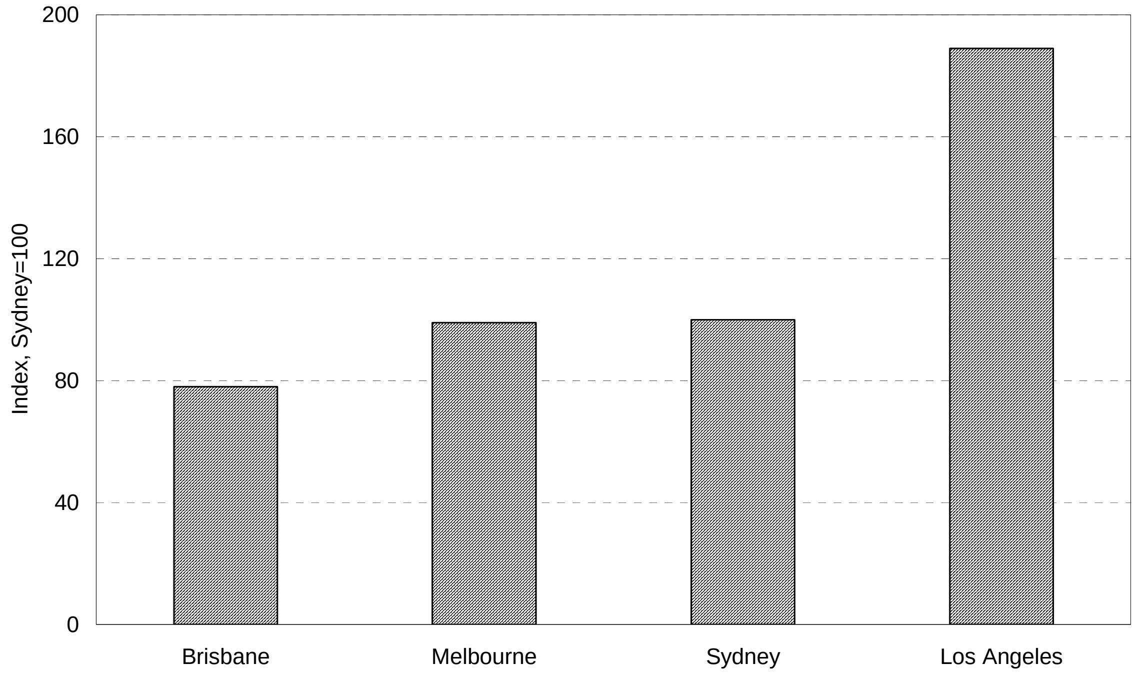


Data source: AmZ 2003.

In 2002, reefer charges at Los Angeles far exceeded those in Australia (see figure 3.2). Previous advice provided to the Commission for the 1998 study indicated that reefer charges in the US trades were higher than in other trades because of a high proportion of porthole containers used in the US (TCS 1997).[3] Another reason is the relative depreciation of the Australian dollar as noted previously.

3 This type of refrigerated container is connected to an external cold air supply and requires relatively large capital expenditure in the terminals.

Figure 3.2 **Relative reefer charges — US West Coast trade, 2002**
Charges in nominal terms per TEU



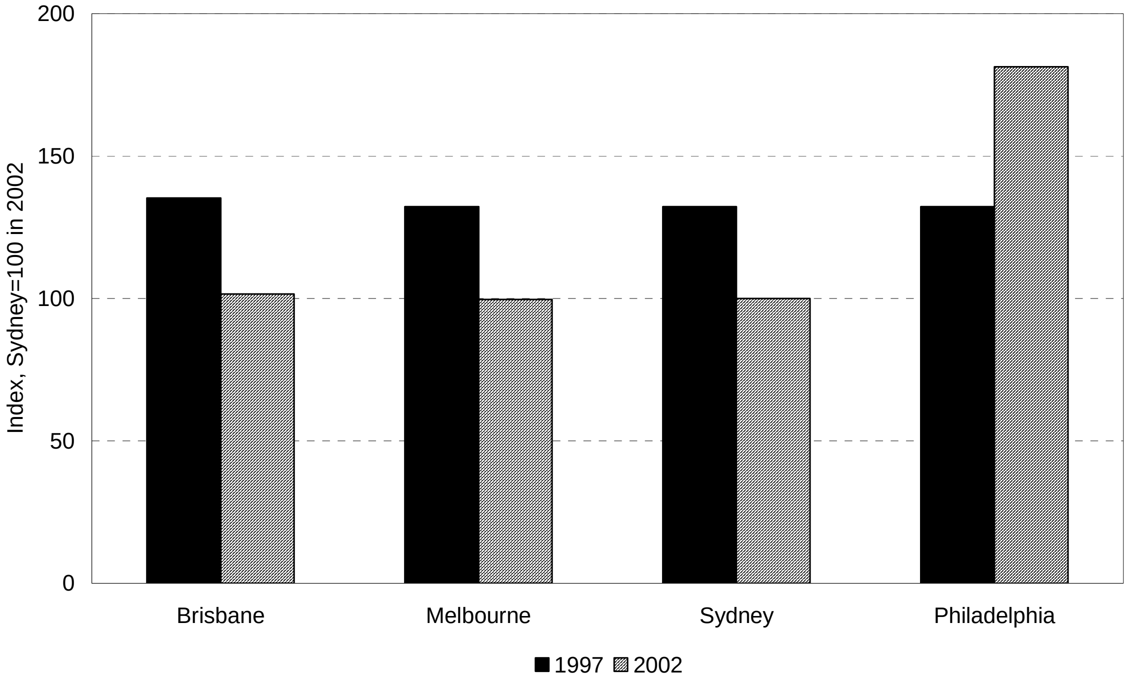
Data source: AmZ 2003.

US East Coast trade

Container handling charges collected for ships operating in the US East Coast trade in 1997 and 2002 are presented in figure 3.3. In 2002, charges in Philadelphia were substantially higher than those of Australian terminals.

Figure 3.3 **Relative container handling charges — US East Coast trade, 1997 and 2002**

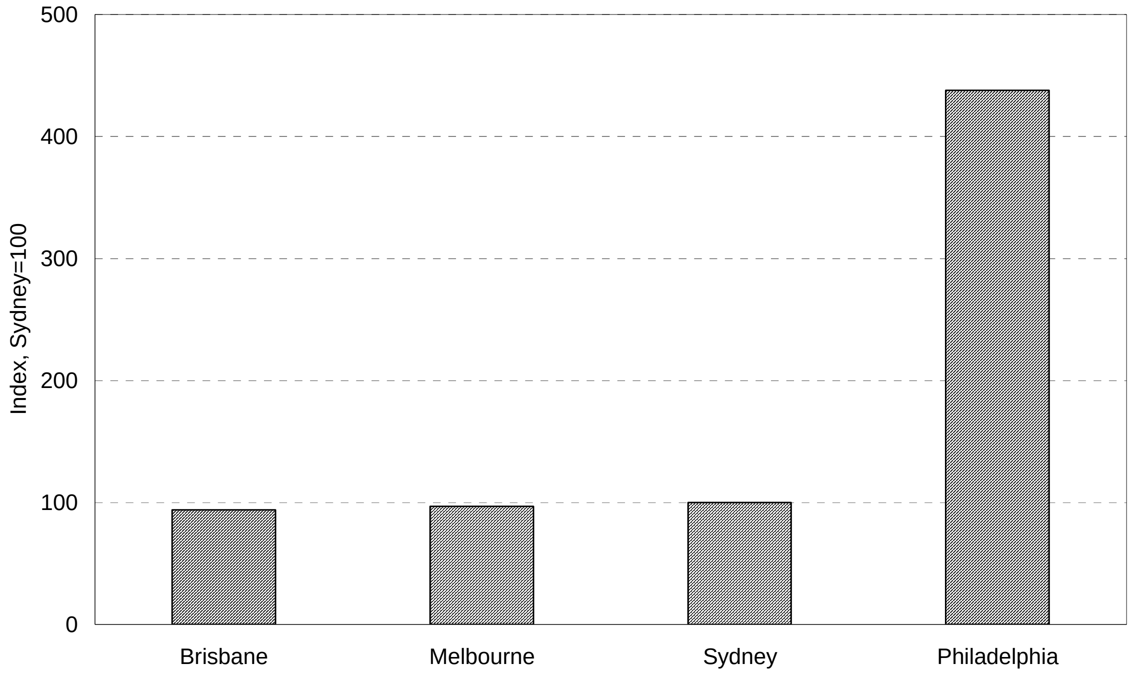
Charges in nominal terms per TEU



Data source: AmZ 2003.

As with conventional containers in 2002, reefer charges were also substantially higher at Philadelphia than at Australian terminals (see figure 3.4).

Figure 3.4 **Relative reefer charges — US East Coast trade, 2002**
Charges in nominal terms per TEU



Data source: AmZ 2003.

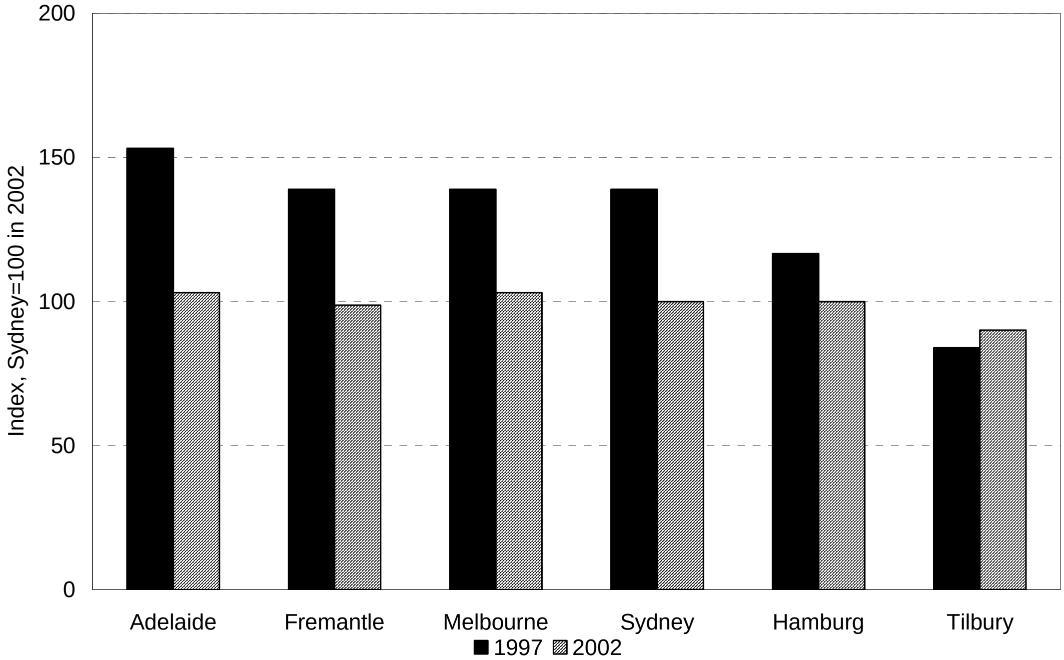
Europe trade

Container handling charges collected for ships operating in the Europe trade in 1997 and 2002 are presented in figure 3.5. In 2002, charges at Hamburg, and to a lesser extent at Tilbury, were comparable with charges at Australian terminals. This represents a relative improvement compared with 1997, when container terminal operators in Hamburg and, to an even greater extent those in Tilbury, charged significantly less than the Australian operators.

Reefer charges are substantially higher at Hamburg and Tilbury than at Australian terminals (see figure 3.6).

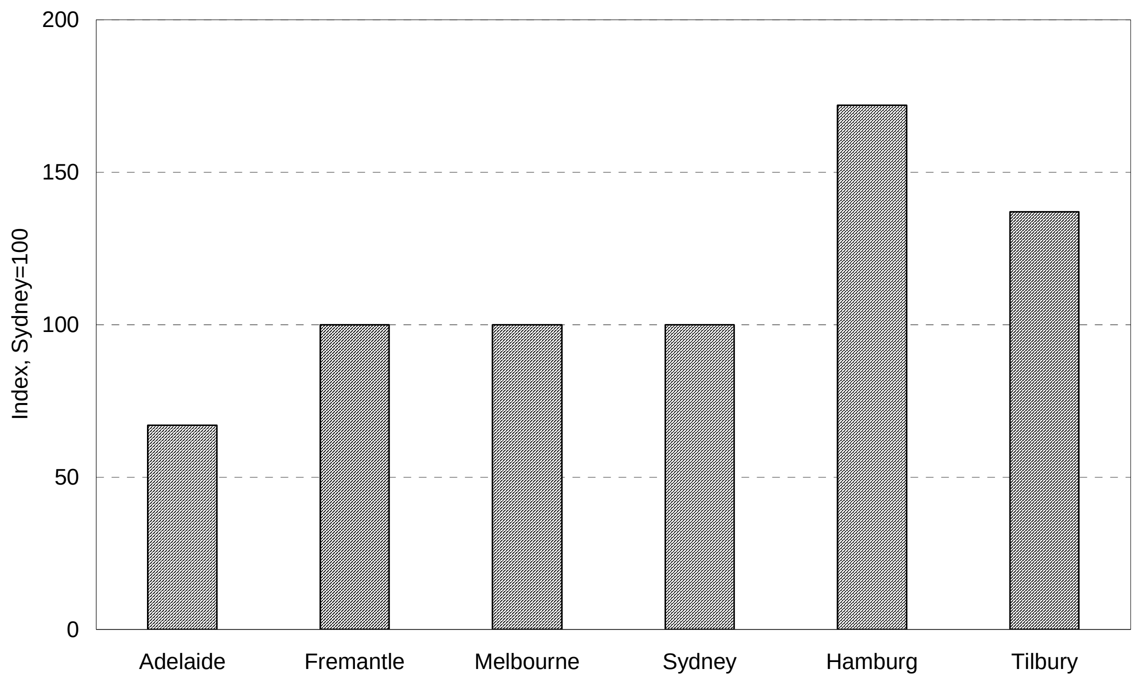
Figure 3.5 **Relative container handling charges — Europe trade, 1997 and 2002**

Charges in nominal terms per TEU



Data source: AmZ 2003.

Figure 3.6 **Relative reefer charges — Europe trade, 2002**
Charges in nominal terms per TEU



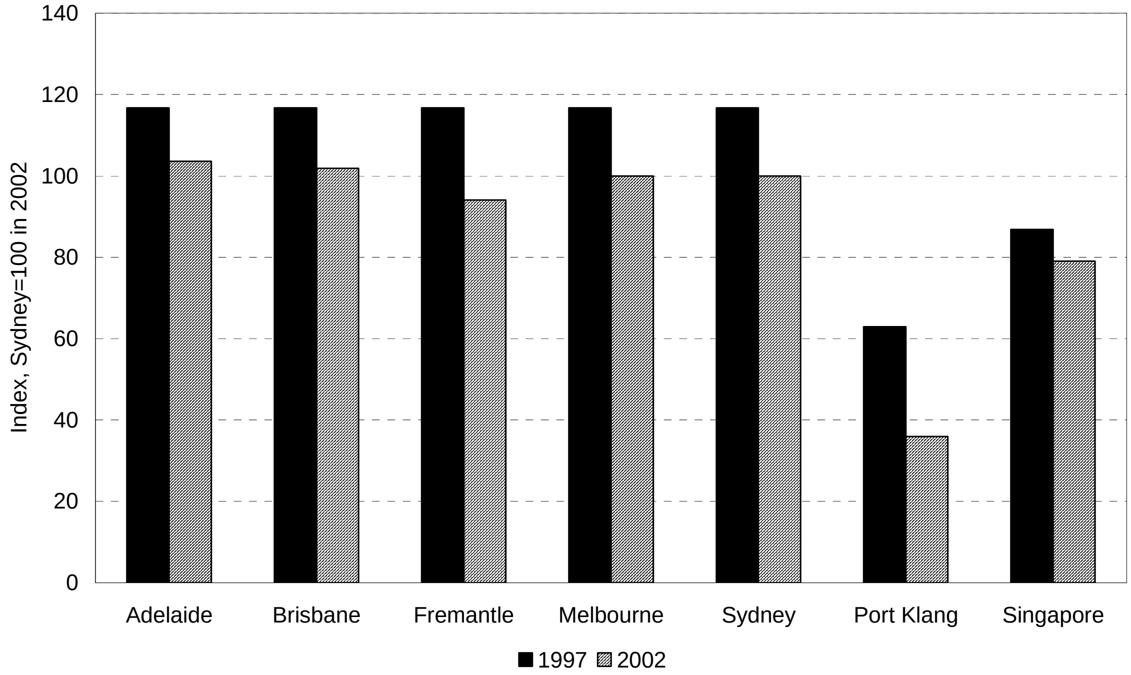
Data source: AmZ 2003.

SE Asia

Container handling charges collected for ships operating in the SE Asia trade in 1997 and 2002 are presented in figure 3.7. In 1997 and 2002, container handling charges at Port Klang and Singapore were significantly lower than at Australian terminals. Although the gap with Singapore has closed slightly, it has increased somewhat for Port Klang.

Figure 3.7 **Relative container handling charges — SE Asia trade, 1997 and 2002**

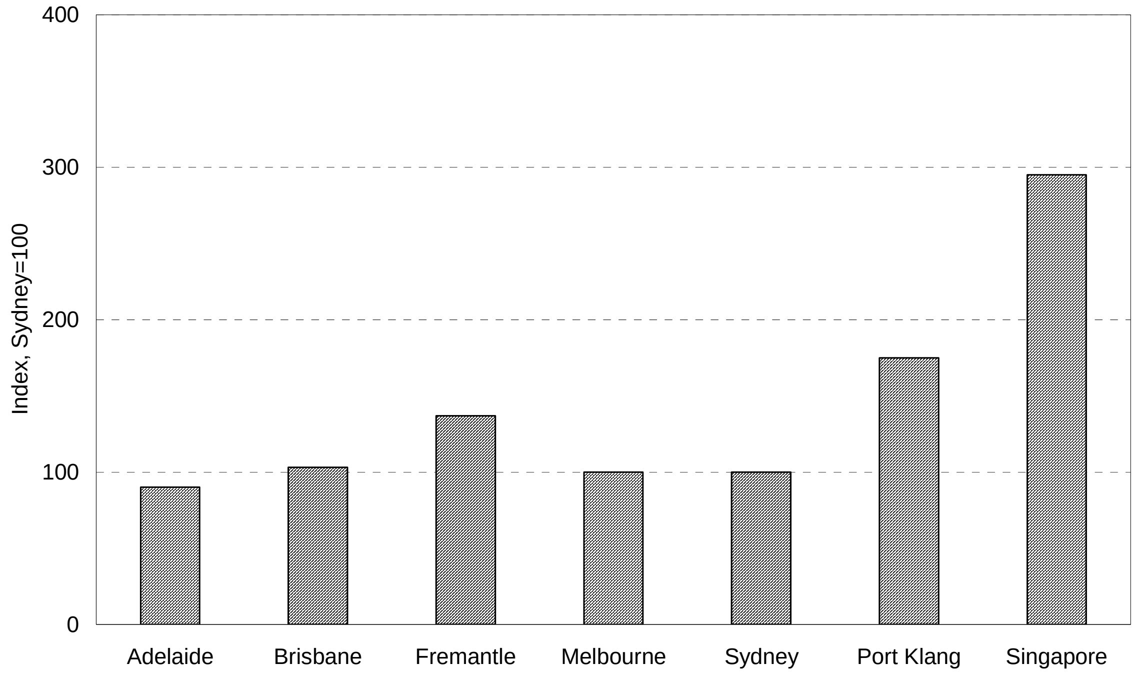
Charges in nominal terms per TEU



Data source: AmZ 2003.

Reefer charges are higher at Port Klang and Singapore than at Australian terminals (see figure 3.8). This is in contrast to the charges for standard (unrefrigerated) containers, where this relativity is reversed.

Figure 3.8 **Relative reefer charges — SE Asia trade, 2002**
Charges in nominal terms per TEU



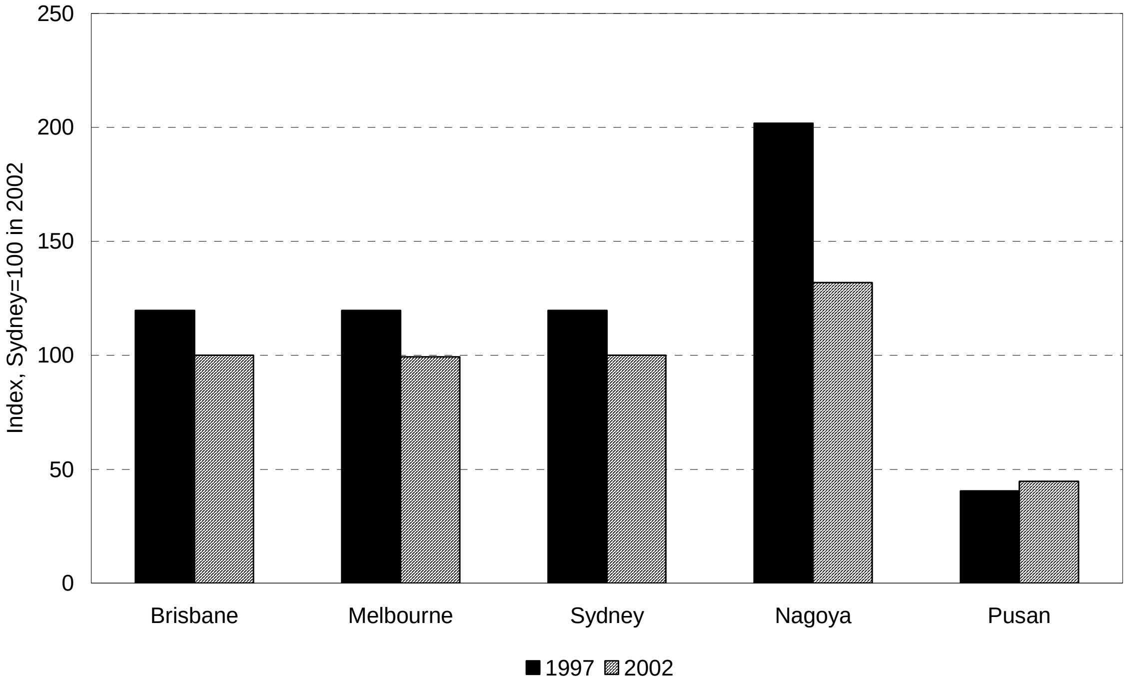
Data source: AmZ 2003.

East Asia

Container handling charges collected for ships operating in the East Asia trade in 1997 and 2002 are presented in figure 3.9. In 1997 and 2002, the charges at Australian terminals were substantially lower than Nagoya and substantially higher than Pusan. However, the difference in the charges has decreased over the period.

Figure 3.9 **Relative container handling charges — East Asia trade, 1997 and 2002**

Charges in nominal terms per TEU

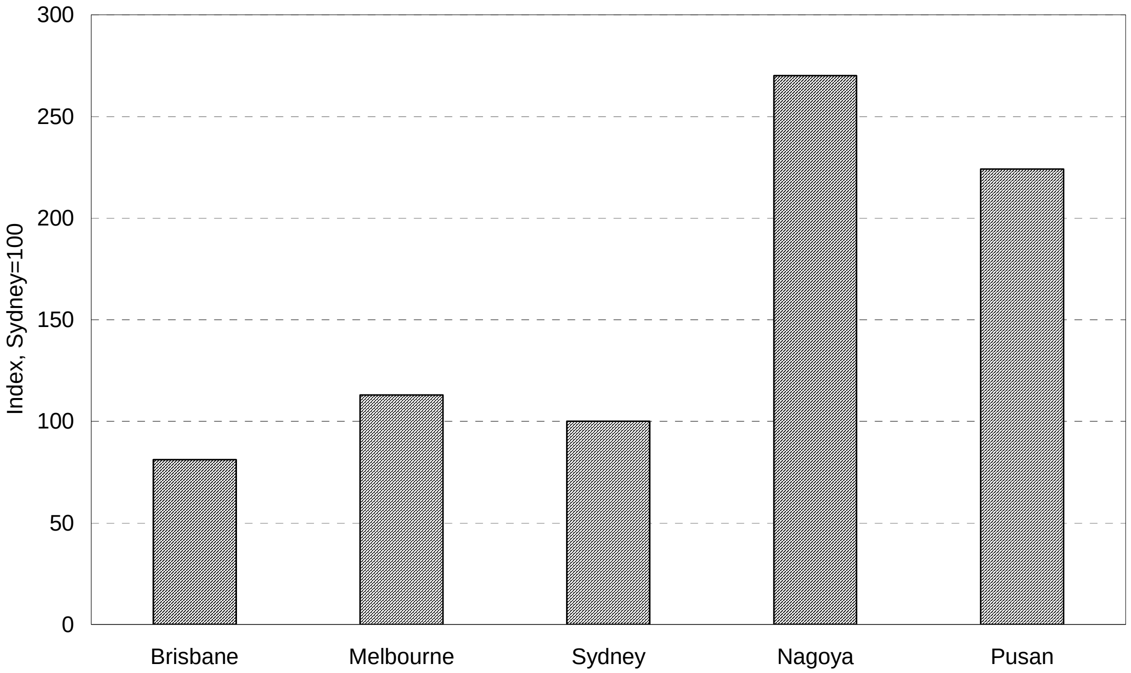


Data source: AmZ 2003

Reefer charges are substantially higher for terminals in Nagoya and Pusan than for Australian terminals (see figure 3.10). Nagoya is recognised as one of the most expensive ports in Asia and this result is consistent, in relative terms, with the charges for standard containers (see figure 3.9).

The opposite is true for Pusan, where charges for standard containers are relatively low and charges for reefers are relatively high (see figure 3.9).

Figure 3.10 **Relative reefer charges — East Asia trade, 2002**
Charges in nominal terms per TEU



Data source: AmZ 2003.

New Zealand

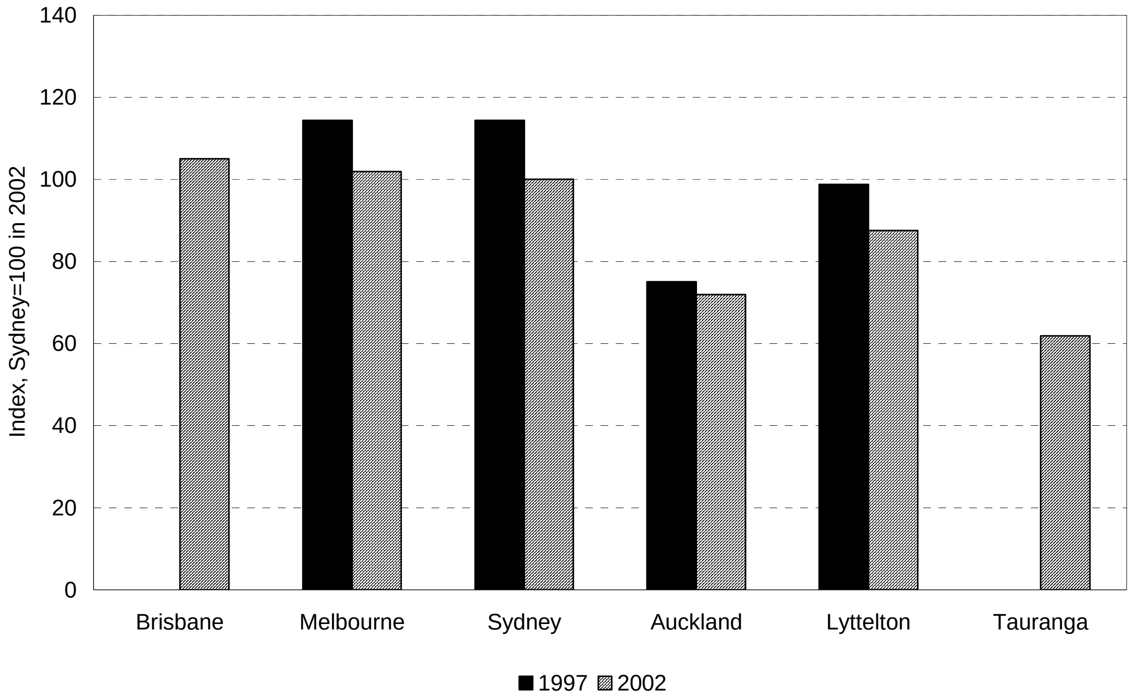
Container handling charges for ships operating in the New Zealand trade in 1997 and 2002 are presented in figure 3.11. In 1997 and 2002, the charges at Melbourne and Sydney terminals were higher than at Auckland and Lyttelton terminals. However, the gap has closed slightly over the period.

In 2002, Tauranga had a significantly lower charge than the three Australian ports in this trade. This is consistent with an observation by AmZ, that terminal operations at Tauranga were extremely efficient (AmZ, New Zealand, pers. comm., January 2003).

Reefer charges at the three New Zealand terminals are somewhat lower than for Melbourne and Sydney, but comparable with Brisbane (see figure 3.12).

Figure 3.11 **Relative container handling charges — New Zealand trade, 1997 and 2002**

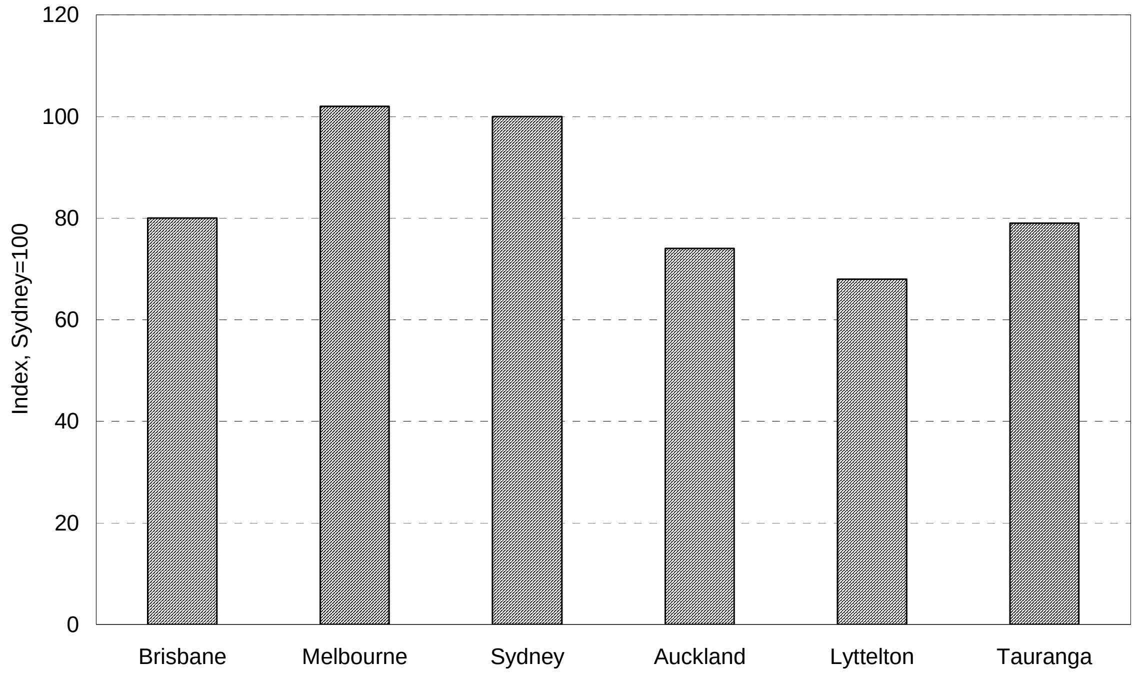
Charges in nominal terms per TEU



Note There was no comparable 1997 data available for Brisbane and Tauranga.

Data source: AmZ 2003.

Figure 3.12 **Relative reefer charges — New Zealand trade, 2002**
Charges in nominal terms per TEU



Data source: AmZ 2003.

3.3 Conclusion

In 1997, container handling charges at Australian terminals were generally higher than those at most of the overseas terminals included in the study. The same was generally true in 2002, although charges at Hamburg and Tilbury had increased almost to the levels at Australian terminals.

There was a major increase in *relative* charges over the period for Los Angeles and Philadelphia. For these two American ports, terminal charges were almost twice the level at Australian terminals in 2002, in contrast with similar levels in 1997.

A contributing factor to terminal charges in Los Angeles and Philadelphia increasing relative to those in Australia, was the change in the exchange rate from US$0.77 to the Australian dollar in 1997, to US$0.56 in 2002. Had the exchange rate remained at its 1997 level, the index of charges for Los Angeles, expressed in Australian dollars, would have increased by less than 40 per cent, compared with the reported increase of 80 per cent.

Charges at New Zealand container terminals were less than at Australian terminals.

Reefer charges at overseas terminals are higher than for Australian terminals, with the exception of those in New Zealand.

In the US West Coast and East Coast trades, Australian container handling charges were roughly comparable with those of US terminals in 1997, whereas in 2002 they were relatively low compared with charges in Los Angeles and Philadelphia. In the Europe trade, Australian terminals had relatively high charges in 1997 compared with Hamburg and Tilbury, whereas in 2002 charges were broadly comparable. A similar relative improvement has occurred at the other overseas terminals, except for Nagoya and Port Klang.

4 Container handling rates

Container handling rates are a commonly used measure of the performance of container terminals. They are not only an indication of the crane operators' efficiency, but also of the efficiency of operations within the terminal.

The measure is of particular interest to ship owners, because handling rates affect the time in which their ships are turned around at the terminal and hence their capital utilisation and revenue-earning capacity. The cost of staying in port an extra day was estimated, using time charter rates, to be $25 000 per day in 1997 for a 2500 Twenty Foot Equivalent Unit (TEU) capacity container ship (PC 1998a).

4.1 Container handling rates as productivity measures

Productivity is usually defined as output per unit of inputs employed. Improvements in container handling productivity can result from advances in technology, more efficient combined use of labour and capital, or more efficient management.

To enable historical comparisons, Net Crane Rates were used for this study as the main measure of container handling productivity. They are influenced by labour and capital productivity, both of which interact. That is, increasing the efficiency of labour will also increase the output of cranes and other terminal capital and *vice versa*.

Definitions

The definitions of crane rates adopted in this study are broadly the same as those used by the Bureau of Transport and Regional Economics (BTRE) in its *Waterline* publication (BTRE 2002b). These definitions, along with comments on their use and interpretation in this study, are described in appendix B.

The number of containers lifted is used as the unit of measurement for crane productivity.[1]

1 The number of TEUs lifted is sometimes used as an alternative unit of measurement. However, this can complicate comparisons because some containers are 40 foot long and counted as two

Study results in the context of BTRE collections

Although the definitions used in collecting data for this study are consistent with those used by the BTRE for *Waterline*, the results would not be expected to be the same, because:

- the sample is different, with the present study covering only a small subset of the census used by the BTRE for *Waterline*;
- the BTRE publishes average figures for all container ships that visit Australia's five main container ports, whereas for purposes of international comparisons, the present study includes data collected by shipping trade, and only for the particular lines and ships sampled from those trades; and
- the data used by the BTRE are supplied by container terminals, whereas the data used for the present study were obtained from shipping lines, with the objective of collecting data that was consistent across countries.

The Commission's consultant (AmZ Ltd) collected Net Crane Rates, Gross Crane Rates and Gross Ship Rates, which are all reported in this chapter. In *Waterline* the BTRE reports Net Crane Rates, Gross Ship Rates (as the Elapsed Labour Rate), and the Net Ship Rate (see box 4.1).

The Net Crane Rates calculated by the Commission's consultants (AmZ Ltd) tend to be somewhat lower on average than the port-average rates published by the BTRE. However, the Gross Ship Rates are similar. The Gross Crane Rates collected by the Commission's consultant are also similar to those derived from BTRE data.

In addition to the different sample and collection procedures, a possible source of difference in the reported Net Crane Rates is the measurement of crane delays as expressed in Time Not Worked (see box 4.1), and the significant increase in Time Not Worked reported in chapter 2. There are many possible causes of crane delays and this may complicate their measurement (see the definition of Elapsed Crane Time in appendix B for the list of delays taken into account).

TEUs. Therefore, although the number of containers handled may be the same when comparing crane productivity, comparisons based on the number of TEUs handled will depend on the proportion of 40 foot containers.

Box 4.1 **Numerical example of productivity calculations**

Assume the following for a typical ship call:

- Number of containers to be handled = 360
- Elapsed labour time = 12 hours (the time that labour is on board the ship)
- Gross crane time = 21 crane hours (calculated by assuming that three cranes are available to work the ship, one for 12 hours, one for 6 hours and one for 3 hours)
- Crane time not worked = 3 hours
- Net crane time = 18 hours (Gross crane time minus 3 hours of crane time not worked)

Then:

- *Gross Crane Rate* (a measure not reported by the BTRE) = 360/21 or 17.1 containers per hour
- *Net Crane Rate (*or *Crane Rate* as referred to by the BTRE*)* = 360/18 or 20 containers per hour
- *Gross Ship Rate* (or the *Elapsed Labour Rate* in BTRE collections) = 360/12 or 30 containers per hour
- *Net Ship Rate* (or *Ship Rate* as used by the BTRE) = *Net Crane Rate* multiplied by *Crane Intensity*
- *Crane Intensity* allows for the possibility of more than one crane working the ship and equals the gross crane time divided by the elapsed labour time or 21/12 = 1.75

In this example:

- *Net Ship Rate* = 20x1.75 = 35 containers per hour
- *Time Not Worked* = 3 hours or 14 per cent of the 21 hours that cranes are available to work the ship.

If for the 360 containers handled, the recorded Time Not Worked were to double to 6 hours, the *Net Crane Rate* would increase from 20 containers per hour to 24 containers per hour. Similarly, the *Net Ship Rate* would increase from 35 containers per hour to 42 containers per hour. However, the *Gross Crane Rate* (17.1), the *Crane Intensity* (1.75), and the *Gross Ship Rate* (30), would all remain unchanged.

Shipping lines' interpretation of delays and their internal reporting processes are likely to be consistent across ports because they operate on a global basis. Any apparent differences in definition and interpretation across shipping lines were corrected for where possible by AmZ.

For some ports — on the East Asia trade for example — Gross and Net Crane Rates collected by AmZ are identical because the consultants were not provided with data on delays.

As noted by Patrick Terminals in their comments on a draft of this report, the 1997 crane rates for the SE Asia trade in Australian terminals appear to be implausibly high — possibly reflecting the small sample size or a data error. No adjustment was made to the 1997 Net Crane Rates. Clearly, if lower rates were imputed for 1997, the overall conclusion of the report — that productivity at Australian terminals has improved in both absolute and relative terms — would be strengthened.

Finally, any differences in the data that arose because of collection procedures or definitional issues are not expected to invalidate the measures of *relative* international performance recorded in this chapter, because the shipping lines operate on a global basis.[2]

4.2 Factors influencing container handling rates

Container handling rates are influenced by a range of factors that are within and outside the control of the terminal operator. Internal factors include terminal layout and the capital resources employed at the terminal, as well as labour productivity.

External factors include trade volumes and associated shipping patterns that influence the extent of any scale economies. Ship size and type are other factors that interact with terminal throughput to influence scale economies and capital utilisation. However, these two factors have been neutralised under the Commission's approach.

The factors described below each have an influence on overall efficiency. However, individual factors cannot be used in isolation to explain differences in handling rates.

Thin trade volumes

The 'thinness' of trade volumes for Australia relative to many other countries, is a significant factor affecting container handling performance. As indicated by the world port rankings in table 2.1 in chapter 2, Melbourne — Australia's largest container port — has a relatively small throughput by international standards.

As a result of thin trade volumes, fewer containers are exchanged at each port call and terminals find it difficult to justify employing more than two cranes to work on a ship.

2 There may be changes in ship type and other factors that would affect comparisons of absolute performance over time. However, the Commission's approach, in measuring differences in relative performance at discrete points in time, reduces the effects of such changes.

Another consequence of thin trade routes is that the intervals between ship calls are longer than they would be on a more heavily trafficked trade. This is exacerbated by the economies of ship operation that favour the use of larger ships over long distances.

Scale economies

In the interests of achieving a minimum economic throughput, there is normally only a small number of container stevedoring companies competing for business at any one port. Depending on the regulatory arrangements and the scope for entry, this can impact on competition and the pressures to improve performance.

There is a minimum efficient scale of operation required to justify the use of container cranes and other heavy container handling equipment, given the variability in ship calls and cargo volumes. Further, economies of massed reserves dictate that the level of reserve plant capacity required to service variable demand, is smaller proportionally as the throughput of the terminal increases. This economy affects the efficient utilisation of capital items such as cranes that have high fixed capacities.

Multi-port calls

Another consequence of thin trade volumes is that shipping lines often need to visit a number of Australian ports in order to collect a full cargo. This is clearly more costly than if it were possible to pick up a full cargo by visiting fewer Australian ports.

In 1999-2000, 3165 ships entered Australia from overseas. They made a total of 9893 port calls: an average of more than three ports visited per ship (BTRE 2002a). A consequence of this pattern of calls is that a delay at one port can have ‘knock on’ effects by delaying visits to other ports.

The prevalence of multi-port calls in Australia also increases the complexity of the container stowage task, because of the need to reposition containers between port calls (known as restows). This requires more crane movements to load and unload containers than if the entire cargo were to be loaded or unloaded at a single port.

Ship size and type

The number of containers exchanged per ship and the size of ship depend on the particular trade. As mentioned above, other things being equal, larger ships can be expected to operate on the longer haul trades. However, thin trade volumes to Australia and New Zealand mean that use of the largest container ships is not viable.

Larger, newer and better equipped ships are easier to load and offload. Among other things, they can be more readily worked by more than one crane, resulting in faster ship turnaround.

Although the methodology used in the study controls for variations in ship size, the data collected reveals a tendency for the number of container lifts per ship to be higher at overseas terminals *vis a vis* the Australian terminals included in this study. Container stowage patterns have an effect on container handling rates. However, it is unclear what if any impact on container handling rates the number of containers lifted per ship call has in isolation.

Terminal configuration

Terminal configuration and layout can affect container handling rates. Loading and unloading operations and the land transport interface for the receival and dispatch of containers can become congested, if the physical layout of the terminal and the type of container handling machinery being used is inadequate.

Further, yard space determines how far containers must be moved between stack and ship. The stack height determines how many containers must be moved to gain access to a container at the bottom of the stack, for example.

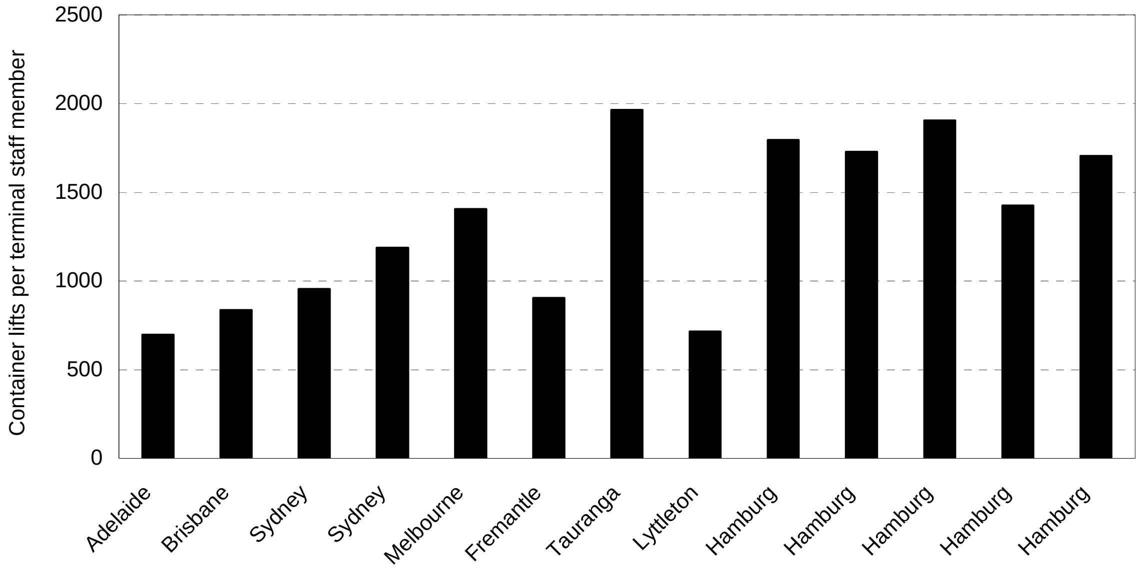
Labour intensity

The data collected by the Commission's consultant on the number of container lifts per terminal employee, shows substantial variation in labour intensity between ports, with Tauranga exhibiting the best performance for this measure.

Australian ports handle relatively small cargo volumes and, with the exception of Lyttelton, tend to handle fewer containers per terminal staff member than northern hemisphere ports (see figure 4.1).[3] However, the data should be interpreted with caution because hiring practices, including the use of contractors, can have a significant effect on the measured labour intensity.

3 Data on staff numbers could not be obtained for all terminals and hence this indicator is shown for only some ports in the study.

Figure 4.1 **Labour intensity — selected ports, 2002**



Note For the ports of Sydney and Hamburg, values are shown for more than one terminal.

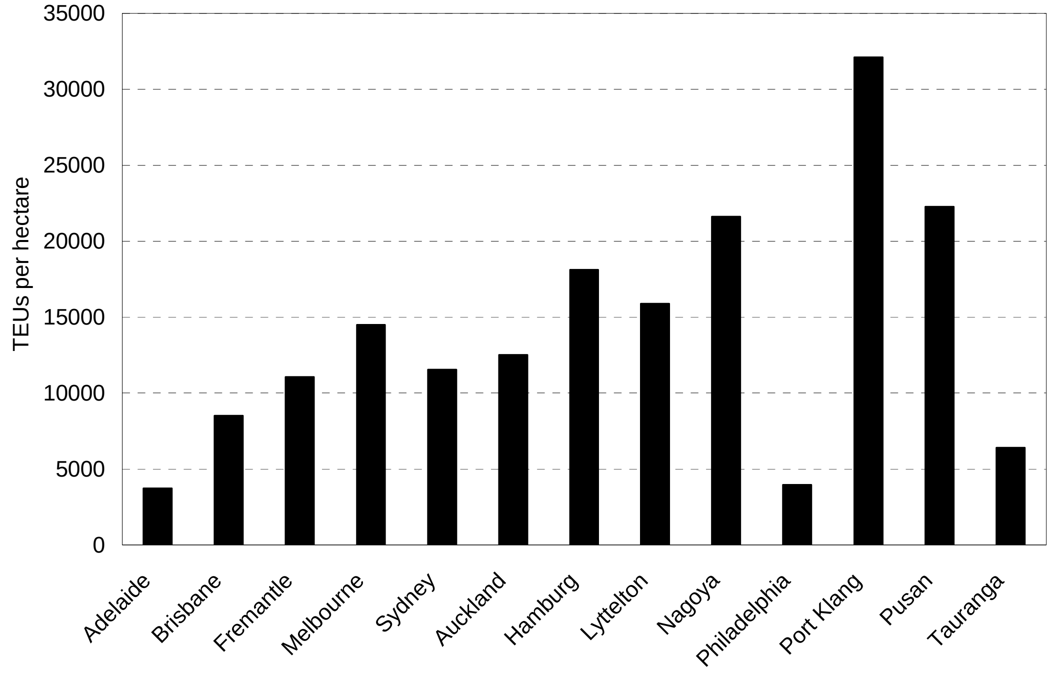
Data source: AmZ 2003.

Yard utilisation

Yard usage is defined as annual throughput divided by the yard area measured in TEUs per hectare. It is an indicator of the efficiency of land usage. Container dwell times and the choice of handling system and hence stacking density, also influence yard capacity.

The proportion of transhipment containers is another relevant factor because these containers are counted twice in the throughput statistic, but have only one visit to the yard. Although there is no international benchmark for yard utilisation, Hamburg and some of the Asian ports stand out as having relatively high throughput per hectare compared with Australian ports (see figure 4.2).

Figure 4.2 **Yard utilisation — selected ports, 2002**

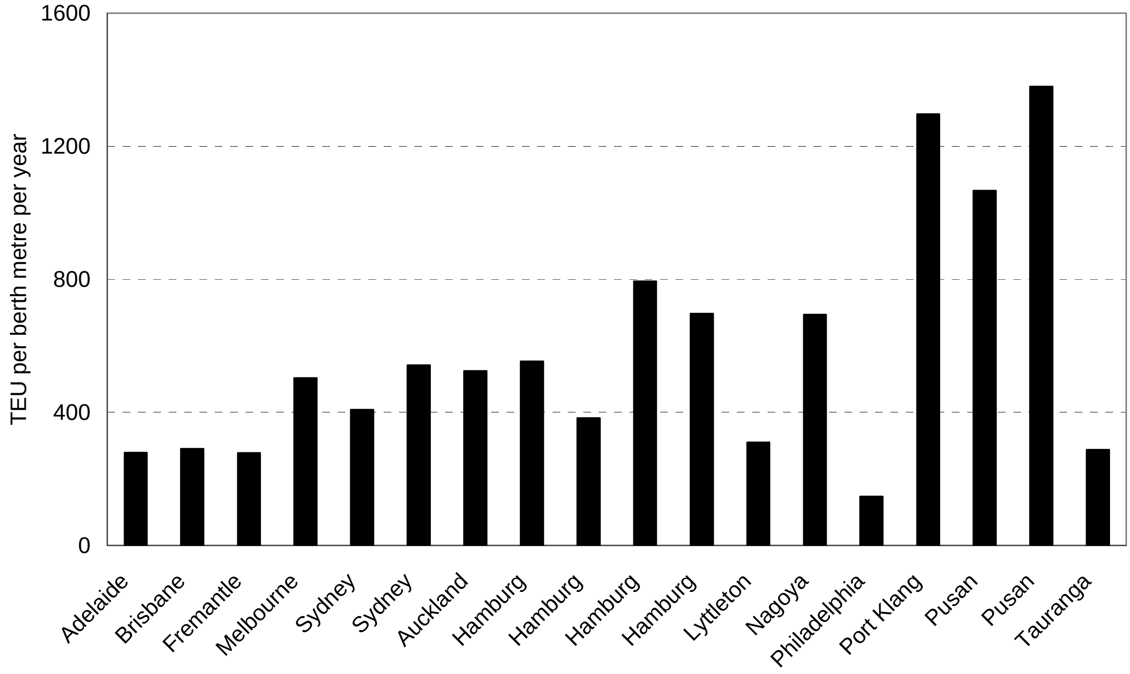


Data source: AmZ 2003.

Berth utilisation

The berth is a major part of a container terminal's infrastructure and assuming other inputs are held fixed, it is desirable to maximise its utilisation. An indicator of throughput is the number of TEUs per berth length in metres. The data reveal that the larger overseas ports in the study — those with relatively large annual throughput in TEUs (see table 2.1 in chapter 2) — also have relatively high berth utilisation figures (see figure 4.3).

Figure 4.3 **Berth utilisation — selected ports, 2002**



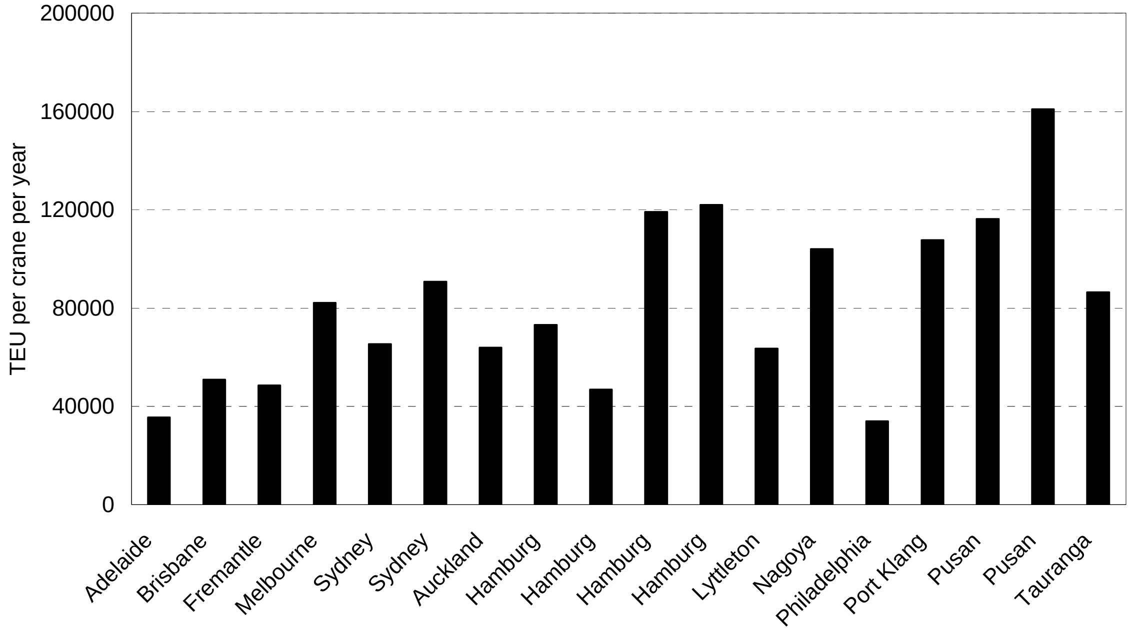
Note For the ports of Sydney, Hamburg and Pusan, values are shown for more than one terminal.

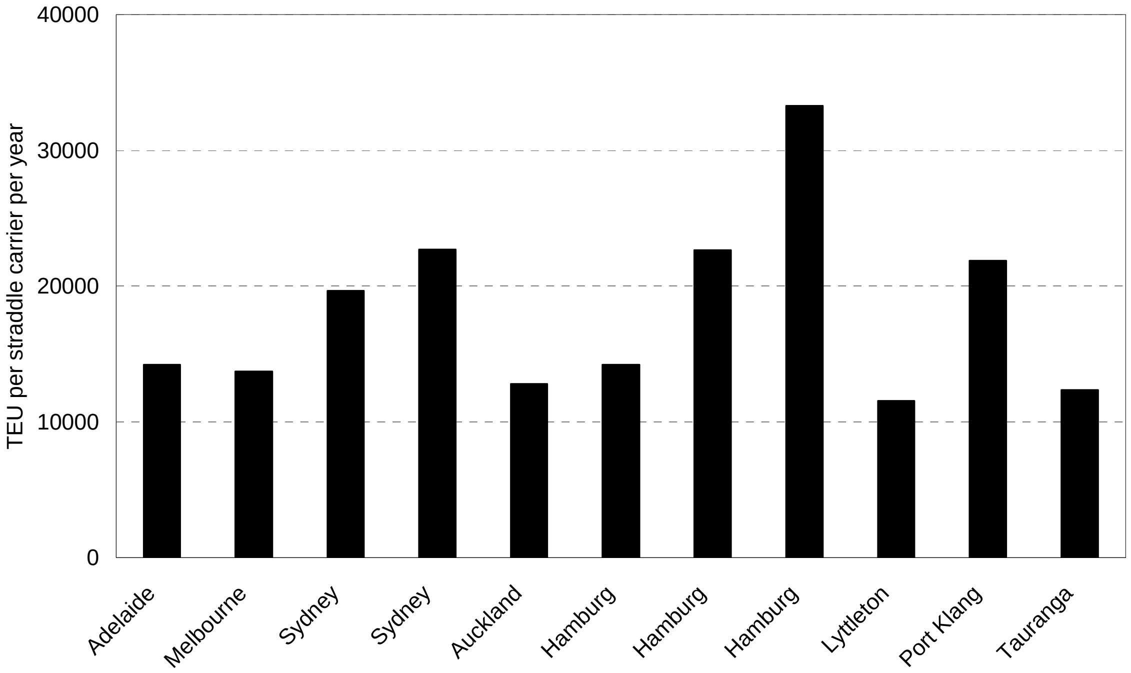
Data source: AmZ 2003.

Crane and straddle carrier utilisation

In addition to berths, quay cranes and the straddle carriers that transport containers within the yard form major elements of a terminal's infrastructure. Again it is desirable to maximise the utilisation of these high capacity individual items of plant. In 2002, the data reveal that terminals in some larger overseas ports achieved higher utilisation rates than Australian terminals. However, this was not always the case, as demonstrated by Philadelphia and at least one of the terminals in Hamburg (see figure 4.4).

Figure 4.4 **Crane and straddle carrier utilisation — selected ports, 2002**





Data source: AmZ 2003.

The logistics chain

Container terminals are but one link in a logistics chain that includes land-side transport operations. The interactions between land-side transport and container terminal operations potentially affect crane handling rates.

A recent report, published by the Rural Industries Research and Development Corporation (RIRDC 2002), emphasised that exporters and stevedoring companies (including container terminal operators) were increasingly looking back up the supply chain to rail and road transport, to achieve greater vertical integration of the logistics chain.

It was concluded in the RIRDC report that greater integration was occurring and that, although the process was far from complete, technology was playing a part in advancing computer-based, seamless integration of communications between transporters, exporters, stevedores and shipping companies. These computer technologies, when applied in these non-stevedoring activities, facilitate efficient movement of containers through terminals and on to ships.

Do these factors impede the performance of Australian container terminals?

As noted earlier in this chapter, crane rates are a partial measure of productivity. They are influenced by labour and capital productivity, both of which interact. Therefore, although it is certain that all of the factors outlined in this section can affect crane rates, it is not possible to determine the extent of their separate influence.

Notwithstanding the preceding caveat, a number of general observations can be made concerning crane rates at Australian terminals compared with overseas terminals. For example, labour intensity tends to be lower and utilisation of terminal infrastructure tends to be higher at overseas ports having relatively large container throughput. Nevertheless, there are exceptions to this generalisation.

Philadelphia has relatively low infrastructure utilisation rates and high container handling charges (see chapter 3). Tauranga on the other hand had very low figures for infrastructure utilisation, but the lowest labour intensity (more container lifts per terminal staff member in figure 4.1) in 2002, and lower charges than Australian terminals (see chapter 3).

The container throughput is smaller at Tauranga than at Melbourne and Sydney, and comparable with Adelaide, Brisbane and Fremantle. Despite the inherent disadvantage of the relatively low throughput at Tauranga, productivity levels reported for that terminal were significantly higher than at the larger Australian ports, suggesting scope for further improvements at Australian terminals.

4.3 Comparisons

Two types of comparison are presented in this section. For each trade a comparison of the Gross Ship Rate, Gross Crane Rate and the Net Crane Rate is presented for 2002. This is followed by a comparison of the Net Crane Rate in 1997 and 2002.

Net Crane Rates are a widely accepted and used measure. The Commission understands that the BTRE adopted this measure on the advice of Australian terminal operators. It was also the measure used in the Productivity Commission's 1998 study (PC 1998a).

Since the 1998 waterfront dispute, attention has generally been focused on the Net Crane Rate as a productivity measure. The Commonwealth Government also nominated a Net Crane Rate of 25 container lifts per hour as a stevedoring reform package target (see chapter 2).

Notwithstanding the historical use of Net Crane Rates, there is a case for using Gross Crane Rates and Gross Ship Rates.

Gross Ship Rates are useful to shipping lines when calculating the port time required to turn a ship around. The use of Gross Ship Rates as a productivity measure was supported in comments on a draft of this report by one of the terminal operators. Also, Gross Ship Rates can be more easily calculated and inserted as productivity guarantees into contractual agreements between shipping lines and terminal operators (AmZ 2003).

Gross Crane Rates are not subject to as many data and definitional issues. For example, there is no allowance for most delays in the calculation of Gross Crane Rate and so their measurement is more reliable.

Delays can be due to operational inefficiencies at a terminal, so that shipping lines do not necessarily accept as unavoidable some of the delays recorded by terminals in calculating Net Crane Rates (AmZ 2003). Net Crane Rates record the productivity of cranes while they are working. However, they do not accurately reflect the productivity of a terminal in turning a ship around.

The Commission has come to the view that for international comparisons of the kind reported in this study, the arguments in favour of gross rather than net measures have particular merit.

US West Coast trade

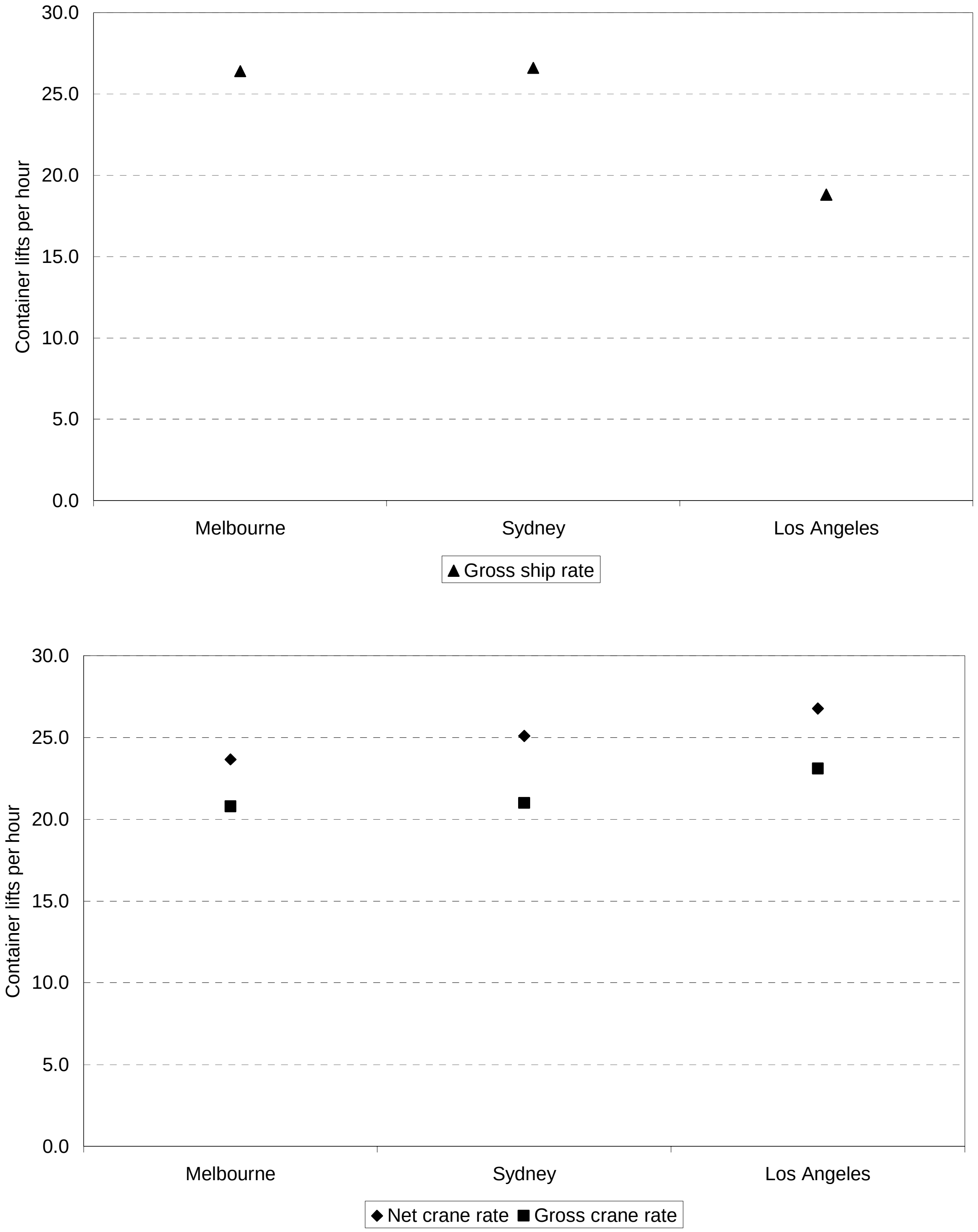
A sample of participating lines and ships was used by the Commission's consultant (AmZ Ltd) to provide data on container handling rates in the US West Coast trade (see table 4.1). In 2002, Gross and Net Crane Rates for Melbourne and Sydney terminals are comparable with those in Los Angeles and the Gross Ship Rate is higher at the Australian terminals (see figure 4.5).

Table 4.1 **Sample size — US West Coast trade, 2002**

Size of samples	*Melbourne*	*Sydney*	*Los Angeles*
Number of lines that participated	3	3	3
Number of lines that provided ship rates	3	3	1
Number of lines that provided Net Crane Rates	2	2	3
Number of ship calls for which data was provided	6	6	17
Average container lifts per ship call	739	609	818

Source: AmZ 2003.

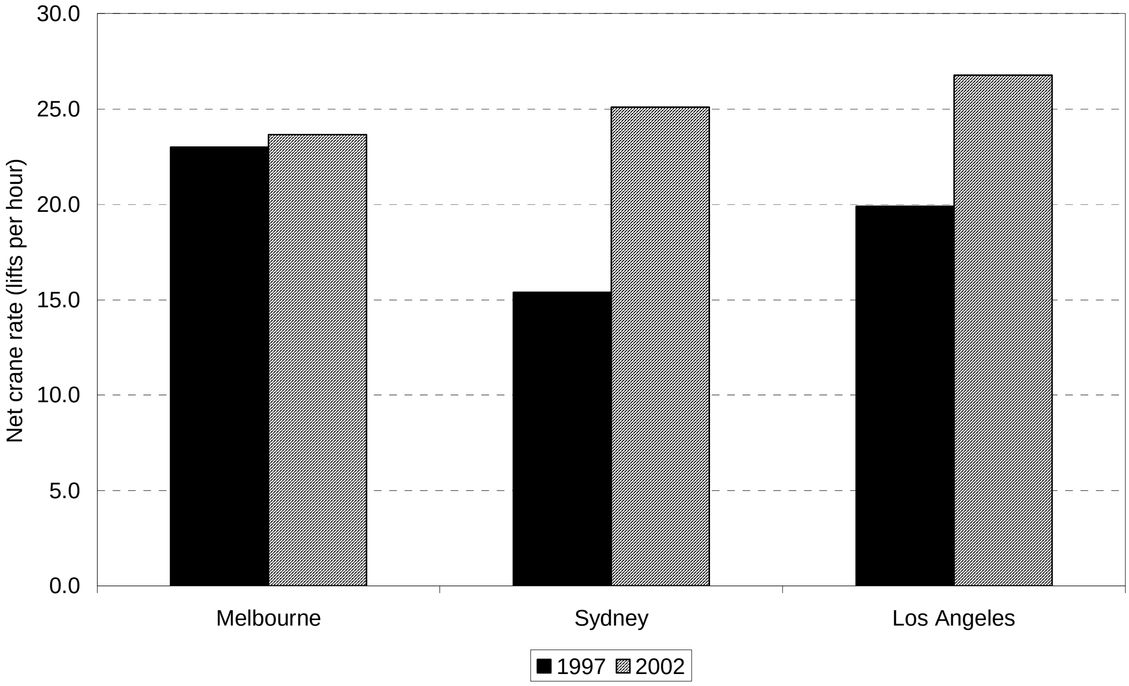
Figure 4.5 **Productivity measures — US West Coast trade, 2002**



Data source: AmZ 2003.

The comparison of Net Crane Rates between 1997 and 2002 reveals that Sydney terminals improved their relative position. However, the absolute performance sampled at Sydney has not increased sufficiently to overtake Los Angeles, where performance has also improved (see figure 4.6).

Figure 4.6 **Comparative Net Crane Rates — US West Coast trade, 1997 and 2002**



Data sources: PC 1998a; AmZ 2003.

US East Coast trade

A sample of participating lines and ships was used by AmZ to provide data on container handling rates (see table 4.2). As noted previously, the average number of containers moved per ship call in the sample was considerably higher at Philadelphia than for the Australian terminals.

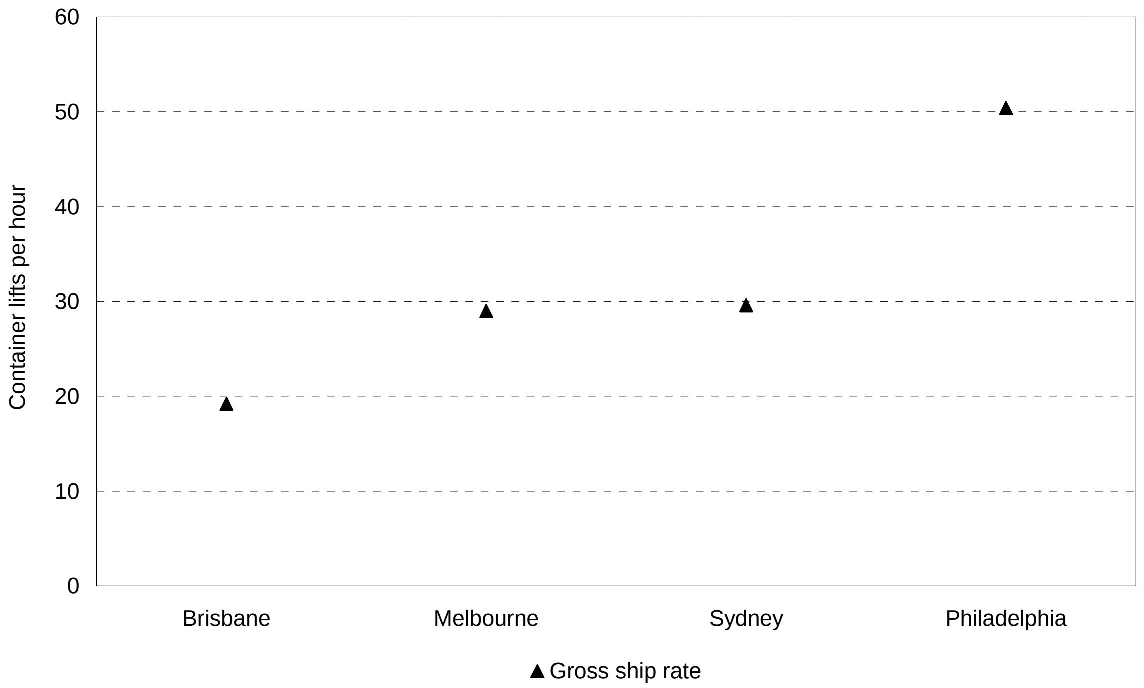
Table 4.2 **Sample size — US East Coast trade, 2002**

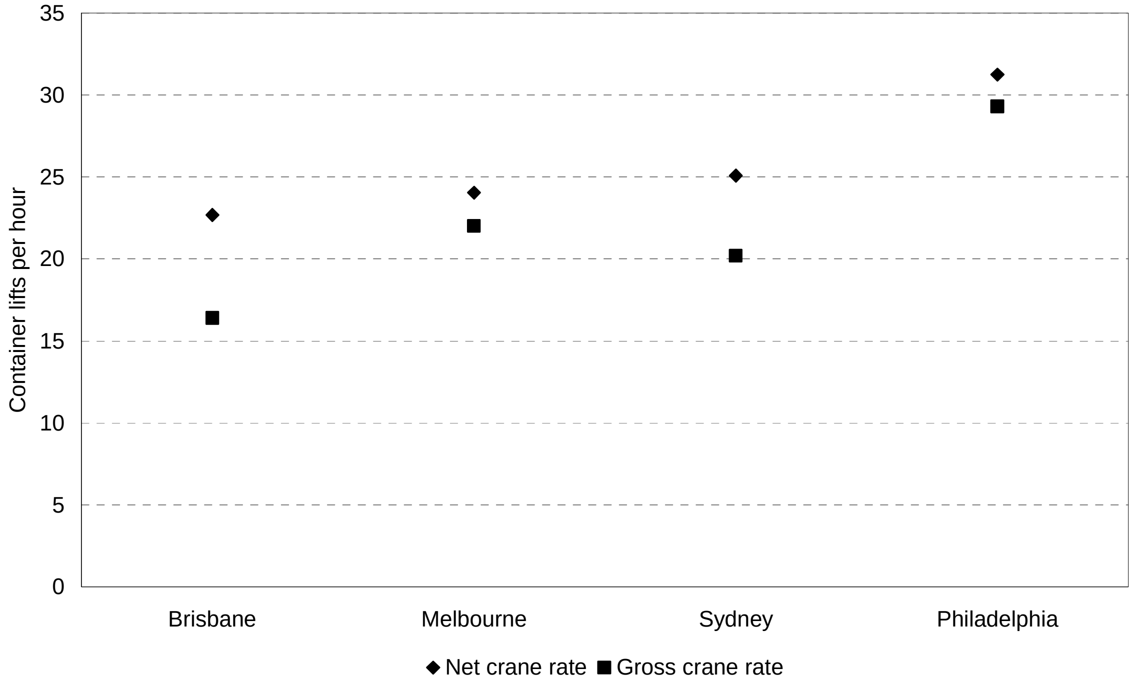
Size of samples	*Melbourne*	*Sydney*	*Brisbane*	*Philadelphia*
Number of lines that participated	3	3	1	3
Number of lines that provided ship rates	3	3	1	3
Number of lines that provided Net Crane Rates	2	2	1	3
Number of ship calls for which data was provided	5	4	2	8
Average container lifts per ship call	590	364	356	1048

Source: AmZ 2003.

In 2002, all three productivity measures for Philadelphia terminals significantly exceeded those at Australian terminals (see figure 4.7).

Figure 4.7 **Productivity measures — US East Coast trade, 2002**

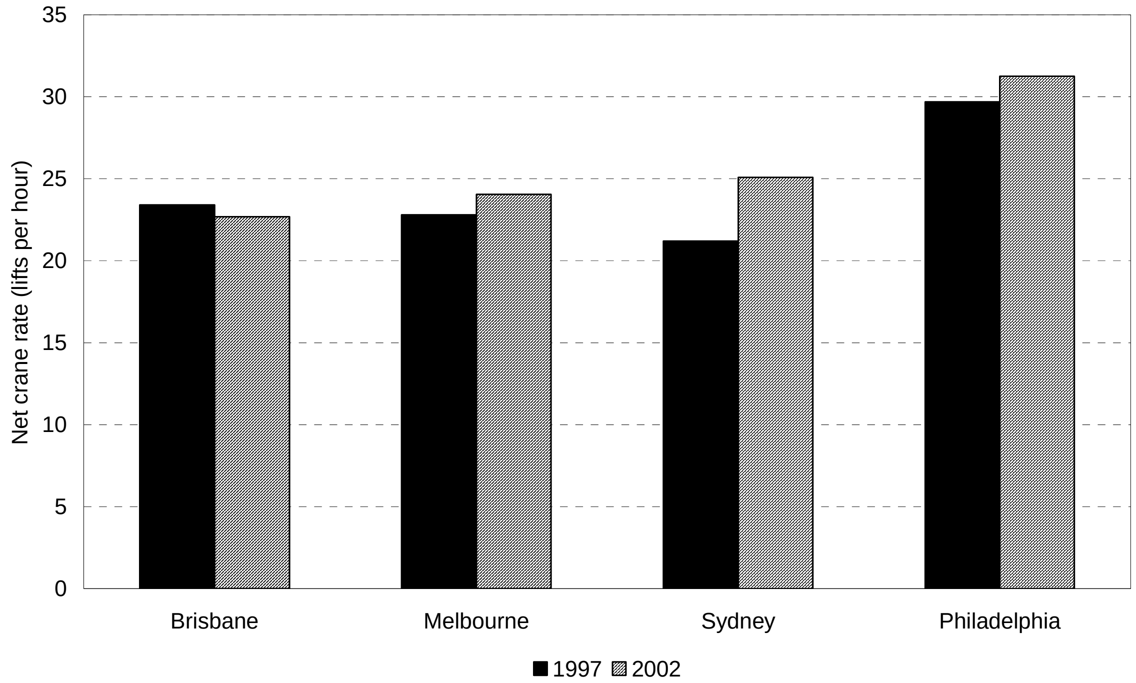




Data source: AmZ 2003.

Between 1997 and 2002, Sydney terminals improved their performance relative to Brisbane and Melbourne, but terminals in all three Australian ports were still somewhat behind those in Philadelphia (see figure 4.8).

Figure 4.8 **Comparative Net Crane Rates — US East Coast trade, 1997 and 2002**



Data sources: PC 1998a; AmZ 2003.

Europe trade

A sample of participating shipping lines and ships on the Europe trade was selected by AmZ to provide data on container handling rates (see table 4.3). For the European terminals, the average number of containers moved per ship call in the sample was somewhat higher than for the Australian terminals.

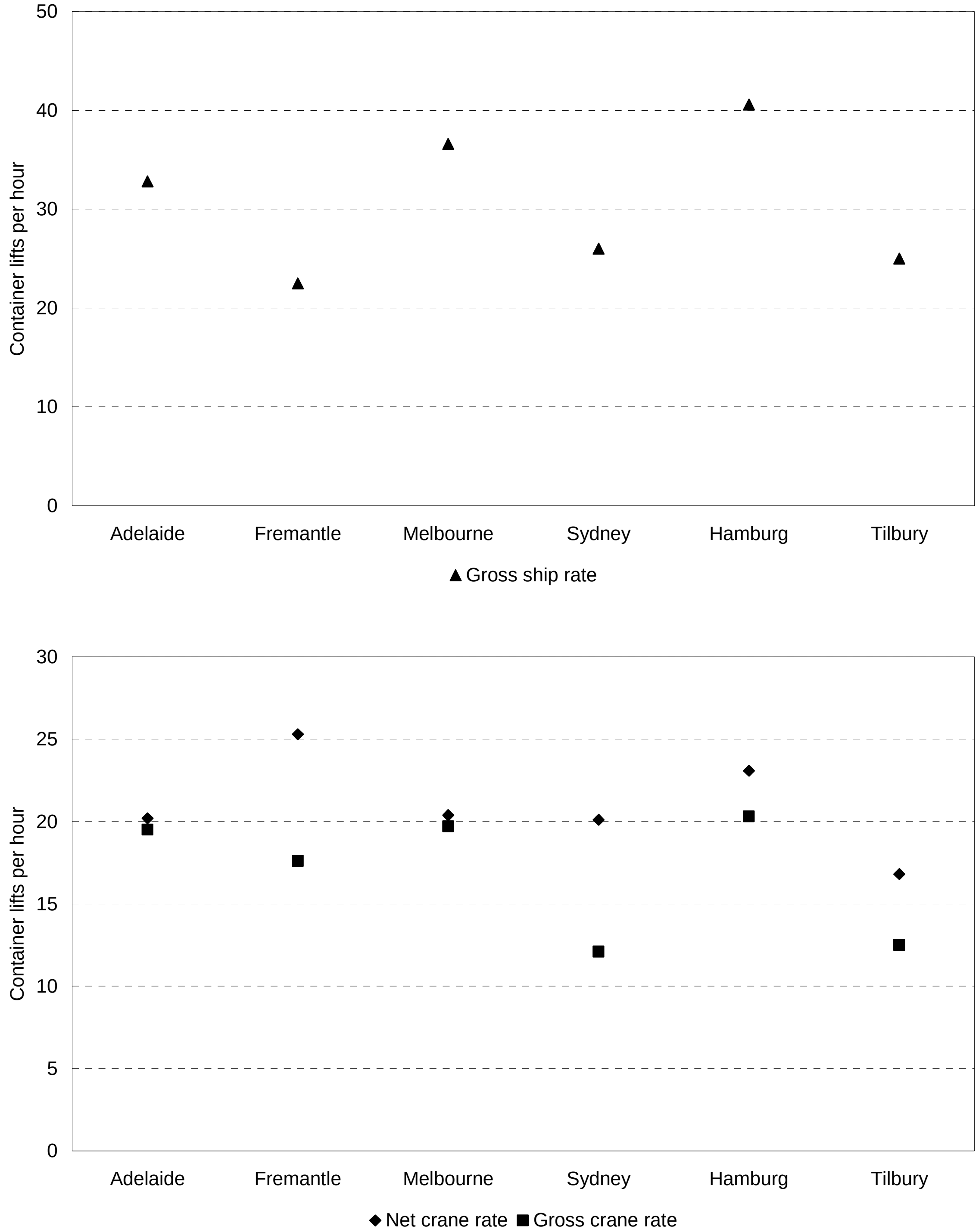
Table 4.3 **Sample size — Europe trade, 2002**

Size of samples	*Adelaide*	*Fremantle*	*Melbourne*	*Sydney*	*Hamburg*	*Tilbury*
Number of lines that participated	2	3	1	1	1	1
Number of lines that provided ship rates	2	3	1	1	1	1
Number of lines that provided Net Crane Rates	2	3	1	1	1	1
Number of ship calls for which data was provided	6	9	3	3	3	3
Average container lifts per ship call	415	162	695	720	1025	1068

Source: AmZ 2003.

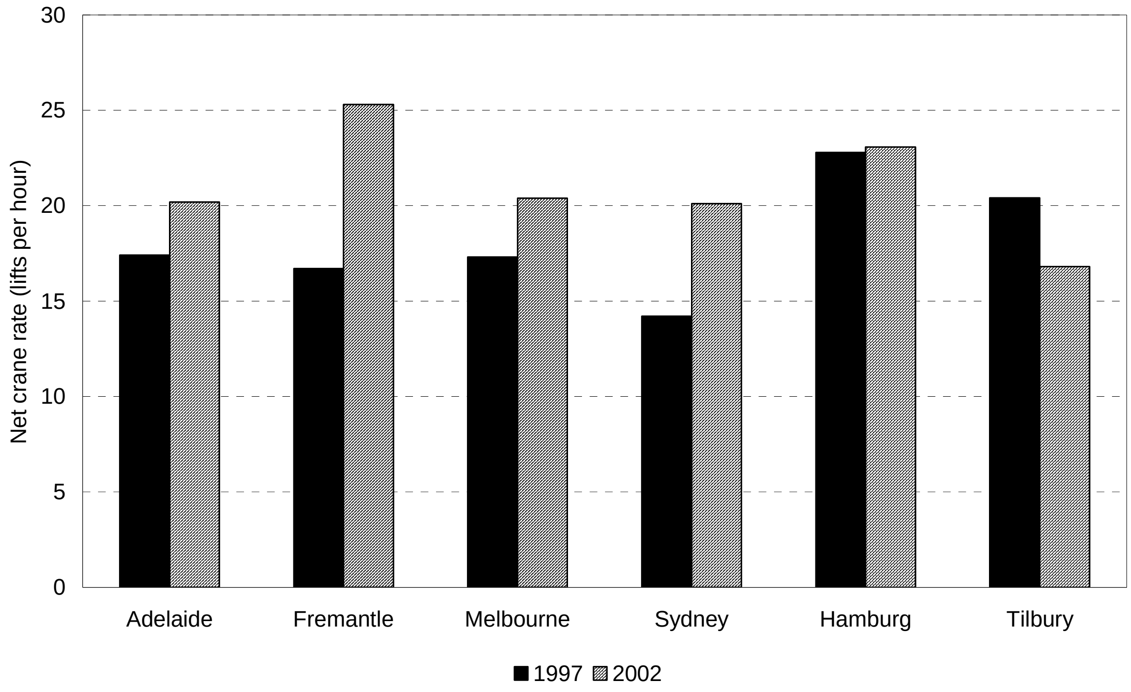
In 2002, Gross and Net Crane Rates at Australian terminals were on a par with those in Hamburg and somewhat better than those in Tilbury (see figure 4.9). Gross Ship Rates at Australian terminals were not as high as at Hamburg, but similar to or better than those in Tilbury.

Figure 4.9 **Productivity measures — Europe trade, 2002**



Data source: AmZ 2003.

Figure 4.10 **Comparative Net Crane Rates — Europe trade, 1997 and 2002**



Data sources: PC 1998a, AmZ 2003.

In 1997, terminals in the Australian ports lagged behind those in Hamburg and Tilbury (see figure 4.10). However, the 2002 results suggest that they have overtaken Tilbury and largely bridged the gap with Hamburg. Indeed, terminals in Fremantle showed higher productivity than those in Hamburg in 2002.

SE Asia results

A sample of participating shipping lines and ships was selected by AmZ to provide data on container handling rates for the SE Asia trade (see table 4.4). Relative to Australian terminals, the average number of containers moved per ship call in the sample was very high at Singapore, but less so at Port Klang.

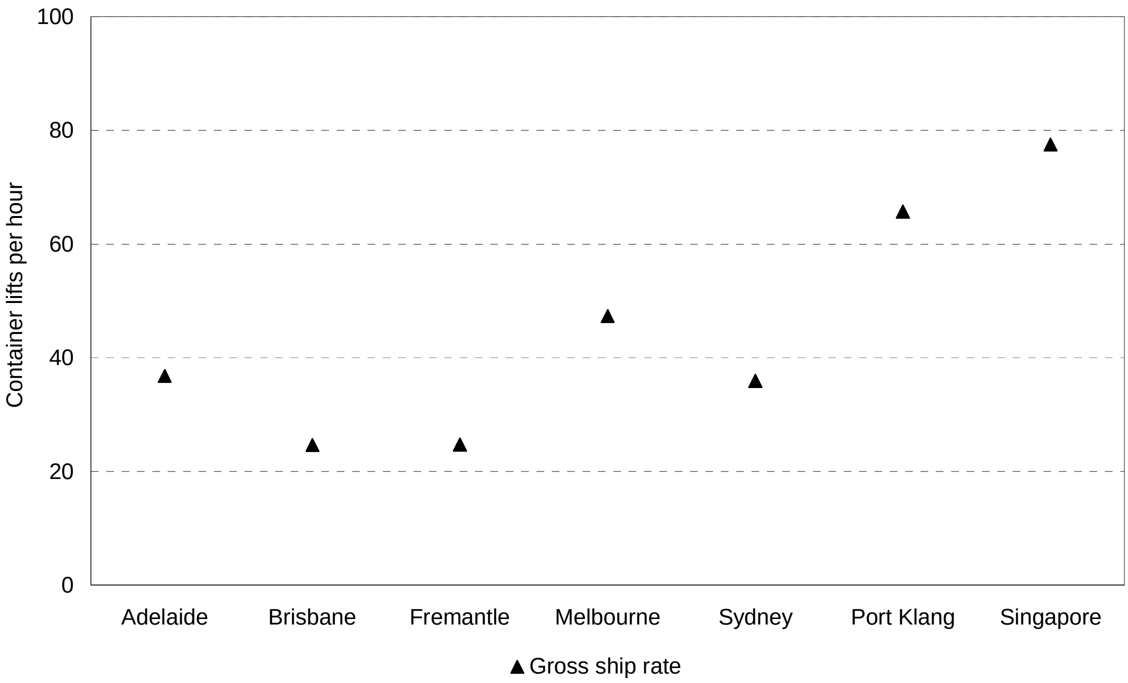
Table 4.4 **Sample size — SE Asia trade, 2002**

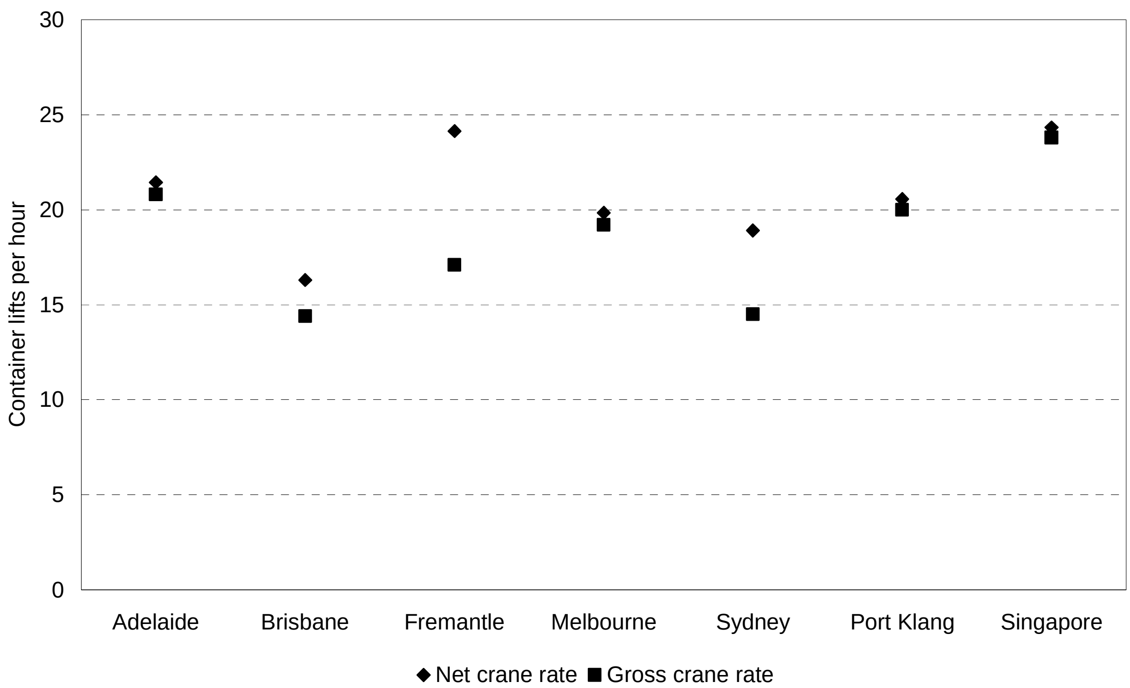
Size of samples	*Fremantle*	*Adelaide*	*Melbourne*	*Sydney*	*Brisbane*	*Port Klang*	*Singapore*
Number of lines that participated	5	4	4	3	1	2	4
Number of lines that provided ship rates	5	4	4	3	1	2	4
Number of lines that provided Net Crane Rates	4	4	4	3	1	2	4
Number of ship calls for which data was provided	40	11	10	9	3	4	12
Average container lifts per ship call	434	467	997	1125	732	722	1836

Source: AmZ 2003.

In 2002, the Gross Ship Rates at Port Klang and Singapore were higher than at Australian terminals (see figure 4.11). However, the Gross and Net Crane Rates were generally on a par or slightly higher than at Australian terminals.

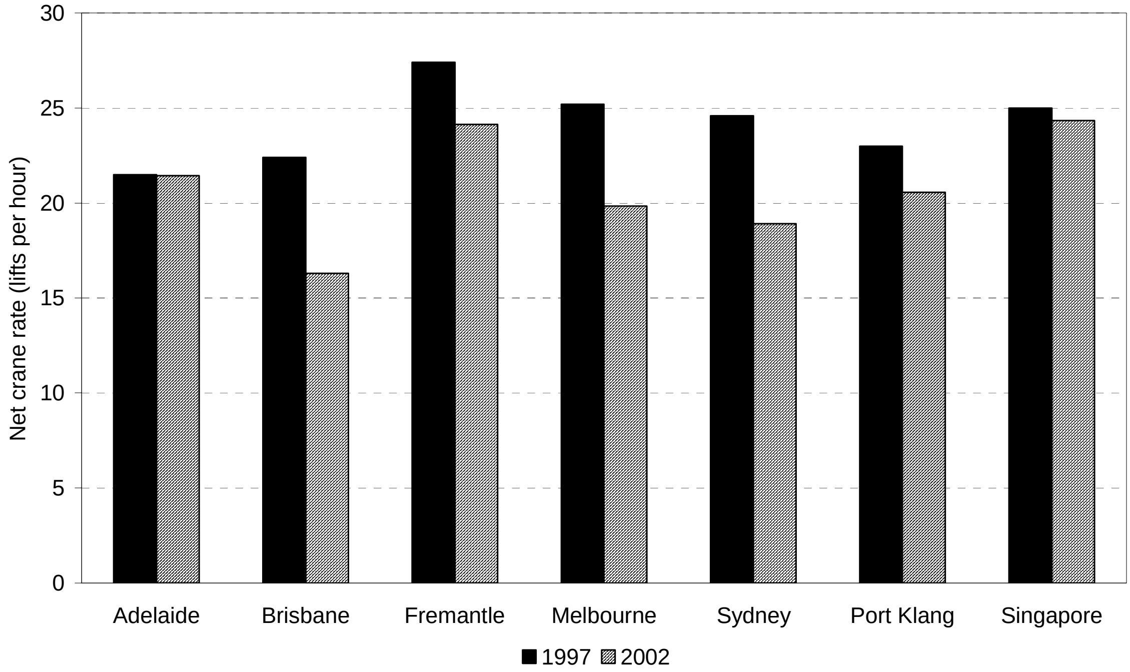
Figure 4.11 **Productivity measures — SE Asia trade, 2002**





Data source: AmZ 2003.

Figure 4.12 **Comparative Net Crane Rates — SE Asia trade, 1997 and 2002**



Data sources: PC 1998a, AmZ 2003.

Productivity appears to have fallen over the period 1997 to 2002 for all ports except Adelaide. However, some of the 1997 Net Crane Rates were implausibly high on this trade, as noted previously in this chapter.[4] In 2002, with more reliable data Australian terminals exhibit broadly similar productivity to those in Port Klang and Singapore (see figure 4.12).

East Asia results

A sample of participating shipping lines and ships was selected by AmZ to provide data on container handling rates for the East Asia trade (see table 4.5). The average number of container lifts per ship call in the sample was comparable for all ports except Nagoya, where the average was relatively low.

4 The fall in rates is also inconsistent with the trend for all other trades and should be discounted as a result.

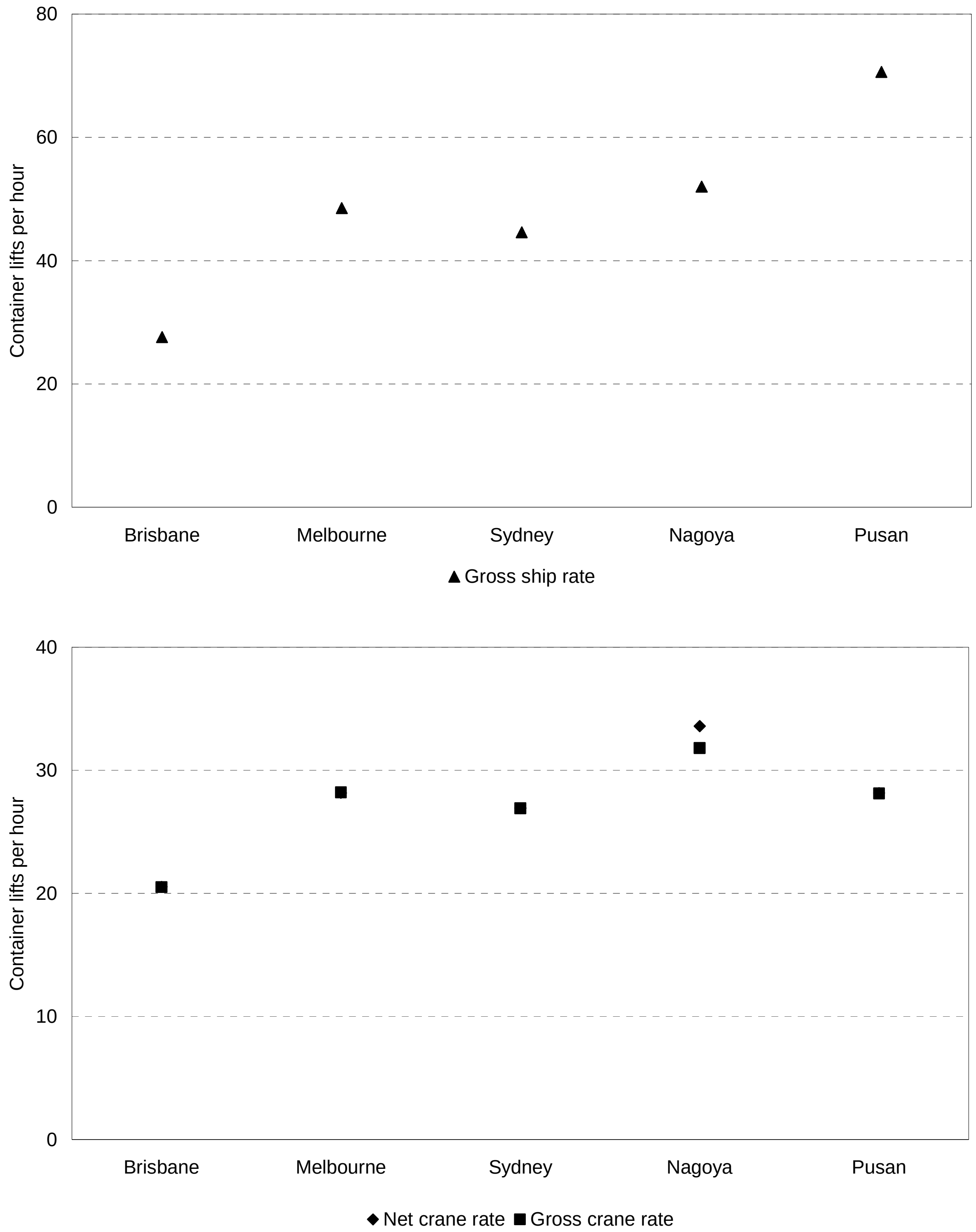
Table 4.5 **Sample size — East Asia trade, 2002**

Size of samples	*Brisbane*	*Melbourne*	*Sydney*	*Nagoya*	*Pusan*
Number of lines that participated	2	3	3	2	1
Number of lines that provided ship rates	2	3	3	2	1
Number of lines that provided Net Crane Rates	1	1	1	2	1
Number of ship calls that data was provided for	13	25	25	6	3
Average container lifts per ship call	903	1653	1364	320	1646

Source: AmZ 2003.

In 2002, productivity was relatively low at Brisbane and relatively high at Pusan (see figure 4.13). The Gross and Net Crane Rates were identical in most cases — with the lines not reporting any crane delays — but in any event, except for Brisbane, the rates at Australian terminals were almost on a par with Nagoya and Pusan.

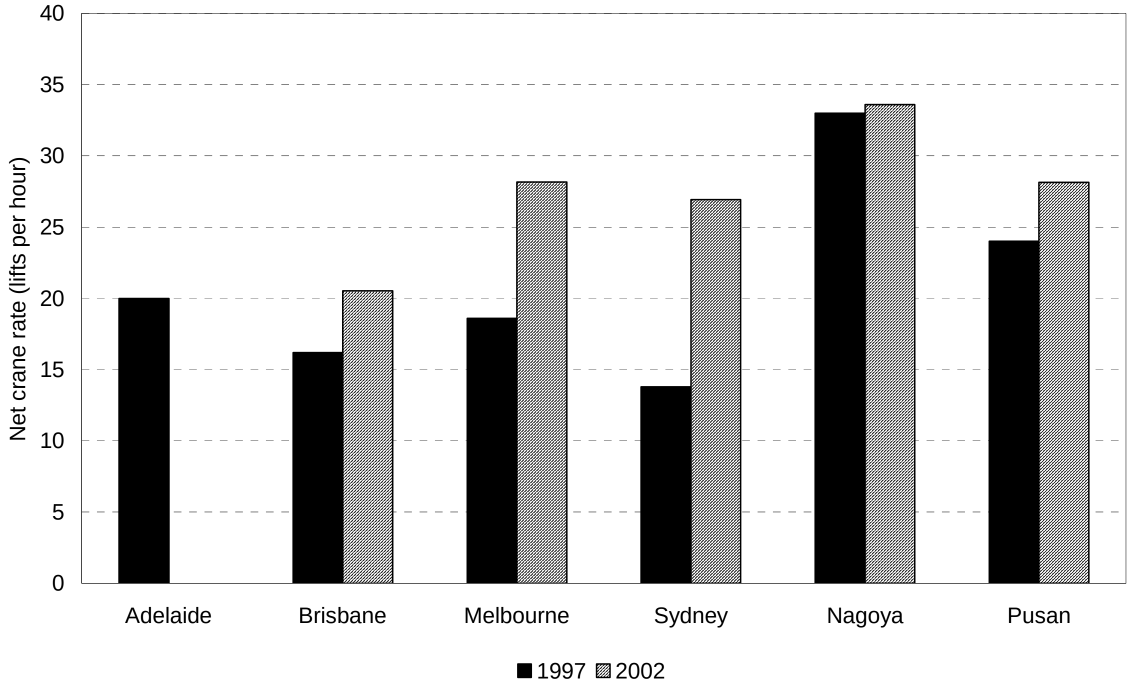
Figure 4.13 **Productivity measures — East Asia trade, 2002**



Note On this trade, Gross and Net Crane Rates are shown as identical for Brisbane, Melbourne, Sydney and Pusan because the consultants were not provided with data on delays.

Data source: AmZ 2003.

Figure 4.14 **Comparative Net Crane Rates — East Asia trade, 1997 and 2002**



Data sources: PC 1998a; AmZ 2003.

Australian terminals have improved their absolute and relative performance since 1997 (see figure 4.14). However, in 2002, Brisbane and Sydney still had slightly lower crane rates than in Nagoya and Pusan — with the gap remaining larger in Brisbane.

New Zealand trade

A sample of participating shipping lines and ships was selected by AmZ to provide data on container handling rates for the New Zealand trade (see table 4.6). The average number of container lifts per ship call was broadly comparable at Australian and New Zealand terminals.

Table 4.6 **Sample size — New Zealand trade, 2002**

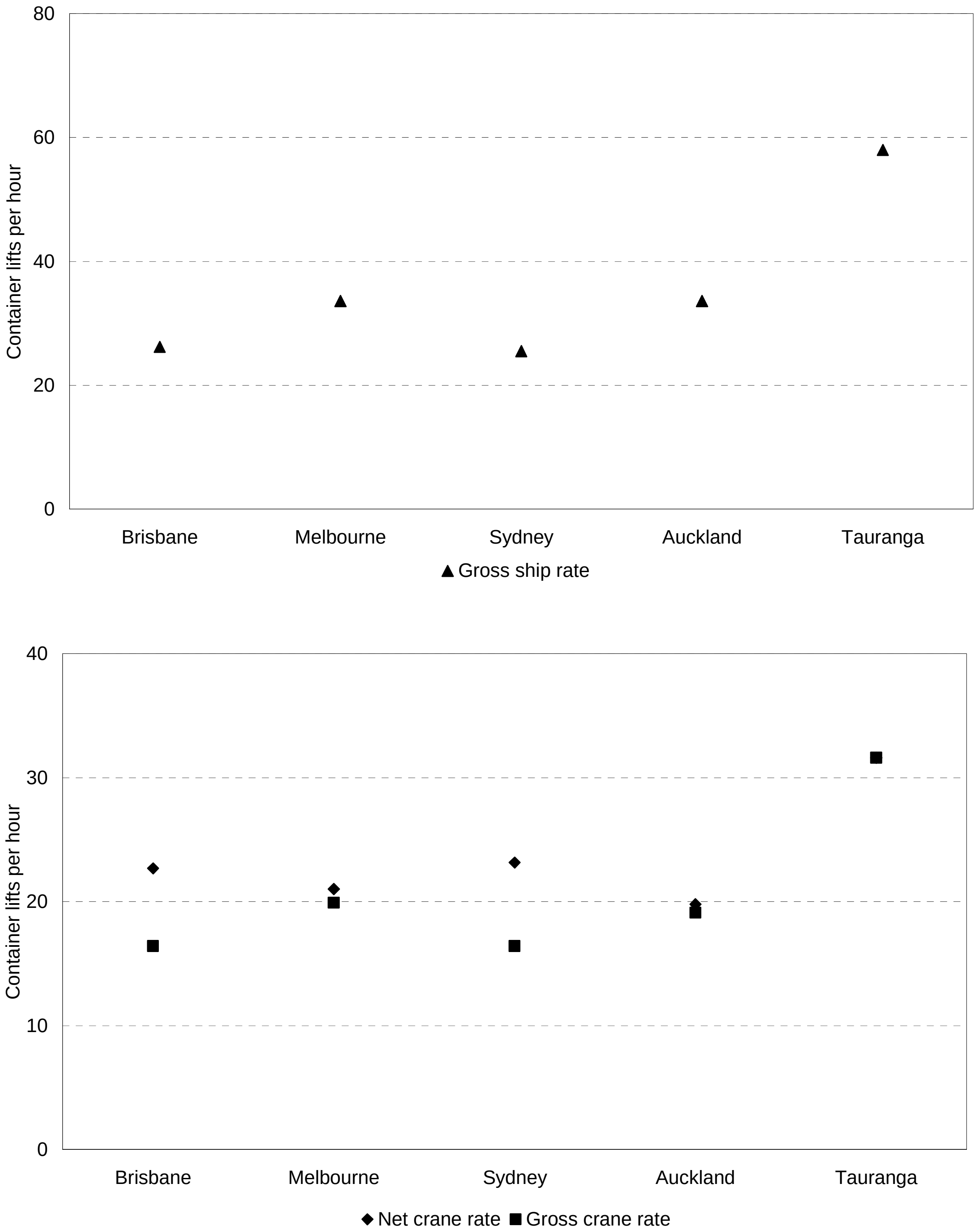
Size of samples	*Brisbane*	*Melbourne*	*Sydney*	*Auckland*	*Tauranga*
Number of lines that participated	2	3	2	3	1
Number of lines that provided ship rates	2	3	2	2	1
Number of lines that provided Net Crane Rates	1	3	2	3	1
Number of ship calls for which data was provided	12	11	9	36	15
Average container lifts per ship call	304	716	772	605	500

Source: AmZ 2003.

Comparable 1997 and 2002 data were not available for the New Zealand trade because of the different type of ships in the two years. In 1997, the ships on the New Zealand trade used their own on-board cranes for container handling purposes.

In 2002, the most noticeable feature of the results is the high productivity at Tauranga relative to Australian terminals for all three measures (see figure 4.15). AmZ indicated that these favourable results were consistent with their knowledge of the terminal at Tauranga and its operations (AmZ, pers. comm., January 2003).

Figure 4.15 **Productivity measures — New Zealand trade, 2002**



Data source: AmZ 2003.

4.4 Are Australian container terminals gaining on their overseas counterparts?

The preceding analysis of Net Crane Rates on a trade basis indicates that Australian terminals have generally improved their productivity, in absolute terms and relative to overseas terminals, since comparable data were collected in 1997.

In order to examine whether Australian container terminals were generally gaining on their overseas counterparts overall, comparisons were made of Net Crane Rates for Australian and overseas port pairs on each of the trades included in the study. This was done for each port pair in 1997 and again in 2002, to ascertain whether the productivity gaps between the port pairs had narrowed or widened.

Outcomes for the port of Sydney are summarized in table 4.7. The third and fourth columns in table 4.7 indicate by how many container lifts per hour the Net Crane Rate at Sydney was higher (a positive number) or lower (a negative number) than at the overseas port pairs studied in 1997 and 2002. The differences in container lifts per hour reflect the productivity gaps between the port pairs.

In the case of the Sydney–Los Angeles port pair, for example, Sydney terminals had a lower average Net Crane Rate than terminals at Los Angeles in both 1997 and 2002. However, the productivity gap between Sydney and Los Angeles, as measured by differences in Net Crane Rates, nevertheless narrowed between 1997 and 2002. The positive value in the fifth column of table 4.7 indicates that there has been a relative performance improvement by Sydney terminals.

The negative values for Singapore and Port Klang in the last column of table 4.7 suggest a deterioration in the relative performance of Sydney terminals. However, this result is suspect because of the implausibly high Net Crane Rates reported for this trade in 1997, identified previously.

Table 4.7 **Net Crane Rate comparisons (container lifts per hour) — Sydney and selected overseas ports, 1997 and 2002**

Port pairs	*Net Crane Rate*		*Productivity gap*[a]		*Change in productivity gap*[b]
	1997	2002	1997	2002	
Sydney	15.4	25.1			
Los Angeles	19.9	26.8	-4.5	-1.7	2.8
Sydney	21.2	25.1			
Philadelphia	29.7	31.3	-8.5	-6.2	2.3
Sydney	14.2	20.1			
Hamburg	22.8	23.1	-8.6	-3.0	5.6
Sydney	14.2	20.1			
Tilbury	20.4	16.8	-6.2	3.3	9.5
Sydney	24.6	18.9			
Singapore	25.0	24.3	-0.4	-5.4[c]	-5.0
Sydney	24.6	18.9			
Port Klang	23.0	20.6	1.6	-1.7[c]	-3.3
Sydney	13.8	26.9			
Nagoya	33.0	33.6	-19.2	-8.7	12.5
Sydney	13.8	26.9			
Pusan	24.0	28.1	-10.2	-1.2	9.0

a Negative values in these columns indicate that Net Crane Rates in Sydney were less than for terminals in the overseas ports with which Sydney was compared, such that a productivity gap exists. The opposite applies for positive values. **b** Negative values in this column indicate that the productivity gap between 1997 and 2002 has widened such that the productivity of Sydney terminals has deteriorated *relative* to those in the selected overseas ports. **c** The Net Crane Rate for Sydney in this year appears to have been overstated (see text).

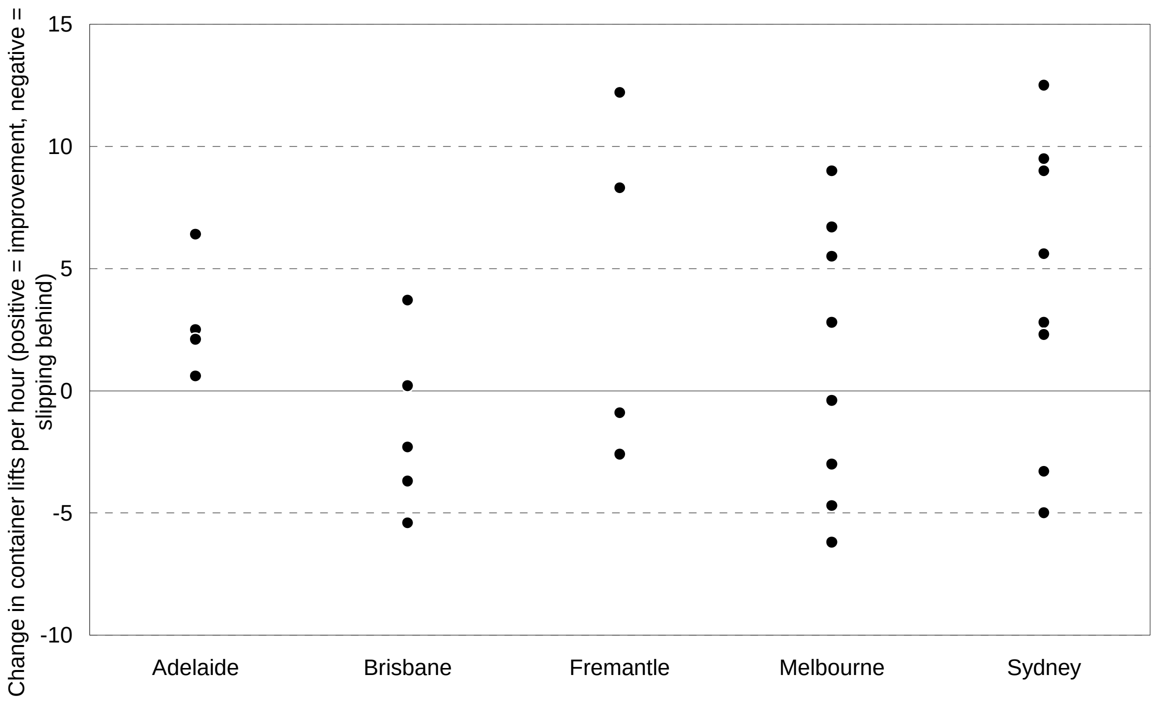
Sources: PC 1998a, AmZ 2003.

The changes in productivity gaps (differences in Net Crane Rate) for all 29 port pairs, are depicted graphically in figure 4.16.[5] Overall, the number of port pairs for which relative performance at the five main Australian ports has improved (18), exceeded the number where container terminals at Australian ports have slipped behind (11). Moreover, the average magnitude of improvement (5.7 container lifts per hour) has been greater than the average magnitude of deterioration

5 The data for the Adelaide, Brisbane, Fremantle and Melbourne port pairs, that underlie figure 4.16, are included in separate tables (numbered 4.17 to 4.20 respectively) in appendix A — expressed in the same format as in table 4.7 for Sydney.

(3.4 container lifts per hour). Again it should be emphasised that these results are likely to underestimate the performance improvements, because Net Crane Rates for the SE Asia trades at Australian terminals appear to have been overestimates in the 1997 data.

Figure 4.16 **Change in Net Crane Rate relativities — Australia's five main container ports, 1997 to 2002**



Data source: Derived from data in AmZ 2003 and PC 1998a.

It seems clear that there has generally been an appreciable reduction in the difference between the Net Crane Rates of Australian container terminals and those at overseas ports between 1997 and 2002. This was achieved despite the disadvantages of smaller throughput and the resulting lower infrastructure utilisation in Australia. That said, there may be scope for further improvement. The terminal in Tauranga has been able to deliver higher productivity and lower charges than its Australian counterparts, even though it has similar or lower throughput.

A Data tables

Table A2.1 **Net Crane Rate — Australian ports, December 1995 to September 2002**

Quarter	*Container lifts per hour*
Dec 95	15.9
Mar 96	16.9
Jun 96	17.7
Sep 96	18.0
Dec 96	17.1
Mar 97	18.4
Jun 97	18.3
Sep 97	18.3
Dec 97	18.5
Mar 98	18.8
Jun 98	18.7
Sep 98	19.1
Dec 98	18.9
Mar 99	19.9
Jun 99	20.3
Sep 99	19.6
Dec 99	19.1
Mar 00	20.4
Jun 00	23.1
Sep 00	24.9
Dec 00	25.5
Mar 01	26.4
Jun 01	26.8
Sep 01	25.8
Dec 01	26.1
Mar 02	26.6
Jun 02	26.9
Sep 02	26.9

Note Data is based on a weighted average of Australia's five main container ports: Brisbane, Sydney, Melbourne, Adelaide and Fremantle.

Source: BTCE, BTRE, *Waterline*, various issues.

Table A2.2 **Time not worked (per cent) — Australia's five main port average, June 1998 to September 2002**

Quarter	*Time not worked (per cent)*
Jun 98	16
Sep 98	15
Dec 98	19
Mar 99	19
Jun 99	17
Sep 99	20
Dec 99	19
Mar 00	20
Jun 00	19
Sep 00	25
Dec 00	29
Mar 01	29
Jun 01	29
Sep 01	29
Dec 01	29
Mar 02	29
Jun 02	27
Sep 02	28

Note Prior to September 1999, the data is for the average of four main ports, because Time Not Worked data were unavailable for Fremantle in that period.

Data source: BTCE, BTRE, *Waterline*, various issues.

Table A2.3 **Average revenue ($/TEU) — Australian stevedores, 1985 to 2002**

Year	*Average revenue ($/TEU)*
1985	238
1986	247
1987	244
1988	244
1989	247
1990	254
1991	244
1992	195
1993	195
1994	201
1995	206
1996	
1997	188
1998	184
1999	180
2000	172
2001	166
2002	165

Note Data unavailable for 1996 and applies to part years thereafter. Average revenue is in nominal dollars for each reported year.

Data source: Derived from ACCC, '*Container Stevedoring*', Report no. 4, December 2002.

Table A3.1 **Relative container handling charges per TEU — US West Coast trade, 1997 and 2002**

Index value, Sydney=100

Terminal location	*1997*	*2002*
Brisbane	102	106
Melbourne	100	100
Sydney	100	100
Los Angeles	84	204

Data source: AmZ 2003.

Table A3.2 **Relative reefer charges per TEU — US West Coast trade, 2002**

Index value, Sydney=100

Terminal location	*2002*
Brisbane	78
Melbourne	99
Sydney	100
Los Angeles	189

Data source: AmZ 2003.

Table A3.3 **Relative container handling charges per TEU — US East Coast trade, 1997 and 2002**

Index value, Sydney=100

Terminal location	*1997*	*2002*
Brisbane	102	102
Melbourne	100	100
Sydney	100	100
Philadelphia	100	181

Data source: AmZ 2003.

Table A3.4 **Relative reefer charges per TEU — US East Coast trade, 2002**

Index value, Sydney=100

Terminal location	*2002*
Brisbane	94
Melbourne	97
Sydney	100
Philadelphia	438

Data source: AmZ 2003.

Table A3.5 **Relative container handling charges per TEU — Europe trade, 1997 and 2002**

Index value, Sydney=100

Terminal location	*1997*	*2002*
Adelaide	110	103
Fremantle	100	99
Melbourne	100	103
Sydney	100	100
Hamburg	84	100
Tilbury	60	90

Data source: AmZ 2003.

Table A3.6 **Relative reefer charges per TEU — Europe trade, 2002**

Index value, Sydney=100

Terminal location	*2002*
Adelaide	67
Fremantle	100
Melbourne	100
Sydney	100
Hamburg	172
Tilbury	137

Data source: AmZ 2003.

Table A3.7 **Relative container handling charges per TEU — SE Asia trade, 1997 and 2002**

Index value, Sydney=100

Terminal location	*1997*	*2002*
Adelaide	100	104
Brisbane	100	102
Fremantle	100	94
Melbourne	100	100
Sydney	100	100
Port Klang	54	36
Singapore	74	79

Data source: AmZ 2003.

Table A3.8 **Relative reefer charges per TEU — SE Asia trade, 2002**

Index value, Sydney=100

Terminal location	*2002*
Adelaide	90
Brisbane	103
Fremantle	137
Melbourne	100
Sydney	100
Port Klang	175
Singapore	295

Data source: AmZ 2003.

Table A3.9 **Relative container handling charges per TEU — East Asia trade, 1997 and 2002**

Index value, Sydney=100

Terminal location	*1997*	*2002*
Adelaide	100	
Brisbane	100	100
Melbourne	100	99
Sydney	100	100
Nagoya	169	132
Pusan	34	45

Data source: AmZ 2003.

Table A3.10 **Relative reefer charges per TEU — East Asia trade, 2002**
Index value, Sydney=100

Terminal location	*2002*
Adelaide	
Brisbane	81
Melbourne	113
Sydney	100
Nagoya	270
Pusan	224

Data source: AmZ 2003.

Table A3.11 **Relative container handling charges per TEU — New Zealand trade, 1997 and 2002**
Index value, Sydney=100

Terminal location	*1997*	*2002*
Brisbane		105
Melbourne	100	102
Sydney	100	100
Auckland	66	72
Lyttelton	86	88
Tauranga		62

Data source: AmZ 2003.

Table A3.12 **Relative reefer charges per TEU — New Zealand trade, 2002**
Index value, Sydney=100

Terminal location	*2002*
Brisbane	80
Melbourne	102
Sydney	100
Auckland	74
Lyttelton	68
Tauranga	79

Data source: AmZ 2003.

Table A4.1 **Labour productivity — selected ports, 2002**

Terminal location	*Container lifts per terminal staff member*
Adelaide	698
Brisbane	836
Sydney	955
Sydney	1186
Melbourne	1406
Fremantle	905
Tauranga	1965
Lyttelton	715
Hamburg	1794
Hamburg	1729
Hamburg	1904
Hamburg	1424
Hamburg	1705

Data source: AmZ 2003.

Table A4.2 **Yard utilisation — selected ports, 2002**

Terminal location	*TEUs per hectare*
Adelaide	3742
Brisbane	8500
Fremantle	11 062
Melbourne	14 511
Sydney	12 321
Auckland	12 520
Hamburg (average)	17 574
Lyttelton	15 876
Nagoya	21 611
Philadelphia	3963
Port Klang	32 110
Pusan	32 174
Singapore	53 982
Tauranga	6408

Data source: AmZ 2003.

Table A4.3 **Berth utilisation — selected ports, 2002**

Terminal location	*TEUs per berth metre per year*
Adelaide	279
Brisbane	291
Fremantle	278
Melbourne	503
Sydney	408
Sydney	542
Auckland	525
Hamburg	553
Hamburg	383
Hamburg	794
Hamburg	697
Lyttelton	310
Nagoya	694
Philadelphia	147
Port Klang	1297
Pusan	1067
Pusan	1379
Tauranga	288

Data source: AmZ 2003.

Table A4.4 **Crane and straddle carrier utilisation — selected ports, 2002**

Terminal location	*TEU per crane per year*	*TEU per straddle carrier per year*
Adelaide	35 545	14 218
Brisbane	51 003	
Fremantle	48 673	
Melbourne	82 230	13 705
Sydney	65 487	
Sydney	90 765	22 691
Auckland	64 000	12 800
Hamburg	73 129	14 219
Hamburg	46 925	
Hamburg	119158	22 640
Hamburg	122 044	33 285
Lyttelton	63 506	11 546
Nagoya	104 094	
Philadelphia	34 000	
Port Klang	107 692	21 875
Pusan	116 364	
Pusan	160 870	
Tauranga	86 514	12 359

Data source: AmZ 2003.

Table A4.5 **Productivity measures — US West coast trade, 2002**

Container lifts per hour

Terminal location	*Gross Ship Rate*	*Net Crane Rate*	*Gross Crane Rate*
Melbourne	26.4	23.7	20.8
Sydney	26.6	25.1	21.0
Los Angeles	18.8	26.8	23.1

Data source: AmZ 2003.

Table A4.6 **Comparative Net Crane Rates — US West Coast trade, 1997 and 2002**

Container lifts per hour

Terminal location	*1997*	*2002*
Melbourne	23.0	23.7
Sydney	15.4	25.1
Los Angeles	19.9	26.8

Data source: AmZ 2003.

Table A4.7 **Productivity measures — US East coast trade, 2002**

Container lifts per hour

Terminal location	*Gross Ship Rate*	*Net Crane Rate*	*Gross Crane Rate*
Brisbane	19.2	22.7	16.4
Melbourne	29.0	24.0	22.0
Sydney	29.6	25.1	20.2
Philadelphia	50.4	31.3	29.3

Data source: AmZ 2003.

Table A4.8 **Comparative Net Crane Rates — US East Coast trade, 1997 and 2002**

Container lifts per hour

Terminal location	*1997*	*2002*
Brisbane	23.4	22.7
Melbourne	22.8	24.0
Sydney	21.2	25.1
Philadelphia	29.7	31.3

Data source: AmZ 2003.

Table A4.9 **Productivity measures — Europe trade, 2002**

Container lifts per hour

Terminal location	*Gross Ship Rate*	*Net Crane Rate*	*Gross Crane Rate*
Adelaide	32.8	20.2	19.5
Fremantle	22.5	25.3	17.6
Melbourne	36.6	20.4	19.7
Sydney	26.0	20.1	12.1
Hamburg	40.6	23.1	20.3
Tilbury	25.0	16.8	12.5

Data source: AmZ 2003.

Table A4.10 **Comparative Net Crane Rates — Europe trade, 1997 and 2002**

Container lifts per hour

Terminal location	*1997*	*2002*
Adelaide	17.4	20.2
Fremantle	16.7	25.3
Melbourne	17.3	20.4
Sydney	14.2	20.1
Hamburg	22.8	23.1
Tilbury	20.4	16.8

Data source: AmZ 2003.

Table A4.11 **Productivity measures — SE Asia trade, 2002**

Container lifts per hour

Terminal location	*Gross Ship Rate*	*Net Crane Rate*	*Gross Crane Rate*
Adelaide	36.8	21.4	20.8
Brisbane	24.6	16.3	14.4
Fremantle	24.7	24.1	17.1
Melbourne	47.3	19.8	19.2
Sydney	35.9	18.9	14.5
Port Klang	65.7	20.6	20.0
Singapore	77.5	24.3	23.8

Data source: AmZ 2003.

Table A4.12 **Comparative crane rate — SE Asia trade, 1997 and 2002**

Container lifts per hour

Terminal location	*1997*	*2002*
Adelaide	21.5	21.4
Brisbane	22.4	16.3
Fremantle	27.4	24.1
Melbourne	25.2	19.8
Sydney	24.6	18.9
Port Klang	23.0	20.6
Singapore	25.0	24.3

Data source: AmZ 2003.

Table A4.13 **Productivity measures — East Asia trade, 2002**

Container lifts per hour

Terminal location	*Gross Ship Rate*	*Net Crane Rate*	*Gross Crane Rate*
Brisbane	27.6	20.5	20.5
Melbourne	48.5	28.2	28.2
Sydney	44.6	26.9	26.9
Nagoya	52.0	33.6	31.8
Pusan	70.6	28.1	28.1

Data source: AmZ 2003.

Table A4.14 **Comparative crane rates — East Asia trade, 1997 and 2002**

Container lifts per hour

Terminal location	*1997*	*2002*
Adelaide	20.0	
Brisbane	16.2	20.5
Melbourne	18.6	28.2
Sydney	13.8	26.9
Nagoya	33.0	33.6
Pusan	24.0	28.1

Data source: AmZ 2003.

Table A4.15 **Productivity measures — New Zealand trade, 2002**

Container lifts per hour

Terminal location	*Gross Ship Rate*	*Net Crane Rate*	*Gross Crane Rate*
Brisbane	26.2	22.7	16.4
Melbourne	33.6	21.0	19.9
Sydney	25.5	23.1	16.4
Auckland	33.6	19.8	19.1
Tauranga	58.0	31.6	31.6

Data source: AmZ 2003.

Table A4.16 **Change in international productivity gap — Australia's five main ports, 1997 to 2002**

Change in productivity gap percentage (+ve = improvement, -ve = slipping behind)

Comparison terminals	*Adelaide*	*Brisbane*	*Fremantle*	*Melbourne*	*Sydney*
Los Angeles				-26.6	22.4
Philadelphia		-11.0		-0.2	15.4
Hamburg	16.7		45.2	18.6	45.6
Tilbury	34.1		55.8	35.6	60.1
Singapore	2.7	-37.5	-9.6	-23.5	-26.9
Port Klang	9.8	-23.7	-1.5	-12.8	-15.5
Nagoya		39.8		58.3	114.2
Pusan		11.1		29.4	69.5

Data source: Derived from data in AmZ 2003 and PC 1998a.

Table A4.17 **Net Crane Rate comparisons (container lifts per hour) — Adelaide and selected overseas ports, 1997 and 2002**

Port pairs	*Net Crane Rate*		*Productivity gap*[a]		*Change in productivity gap*[b]
	1997	2002	1997	2002	
Adelaide	17.4	20.2			
Hamburg	22.8	23.1	-5.4	-2.9	2.5
Adelaide	17.4	20.2			
Tilbury	20.4	16.8	-3.0	3.4	6.4
Adelaide	21.5	21.4			
Singapore	23.0	20.8	-3.5	-2.9	0.6
Adelaide	21.5	21.4			
Port Klang	25.0	24.3	-1.5	0.6	2.1

a Negative values in these columns indicate that Net Crane Rates in Adelaide were less than for terminals in the overseas ports with which Adelaide was compared, such that a productivity gap exists. The opposite applies for positive values. **b** Negative values in this column indicate that the productivity gap between 1997 and 2002 has changed, or in this circumstance widened, such that the productivity of Adelaide terminals has deteriorated *relative* to those in the selected overseas ports.

Source: PC 1998a, AmZ 2003.

Table A4.18 **Net Crane Rate comparisons (container lifts per hour) — Brisbane and selected overseas ports, 1997 and 2002**

Port pairs	*Net Crane Rate*		*Productivity gap*[a]		*Change in productivity gap*[b]
	1997	2002	1997	2002	
Brisbane					
Los Angeles	19.9	26.8			
Brisbane	23.4	22.7			
Philadelphia	29.7	31.3	-6.3	-8.6	-2.3
Brisbane	22.4	16.3			
Singapore	25.0	24.3	-2.6	-8.0	-5.4
Brisbane	22.4	16.3			
Port Klang	23.0	20.6	-0.6	-4.3	-3.7
Brisbane	16.2	20.5			
Nagoya	33.0	33.6	-16.8	-13.1	3.7
Brisbane	16.2	20.5			
Pusan	24.0	28.1	-7.8	-7.6	0.2

a Negative values in these columns indicate that Net Crane Rates in Brisbane were less than for terminals in the overseas ports with which Brisbane was compared, such that a productivity gap exists. The opposite applies for positive values. **b** Negative values in this column indicate that the productivity gap between 1997 and 2002 has changed, or in this circumstance widened, such that the productivity of Brisbane terminals has deteriorated *relative* to those in the selected overseas ports.

Source: PC 1998a, AmZ 2003.

Table A4.19 **Net Crane Rate comparisons (container lifts per hour) — Fremantle and selected overseas ports, 1997 and 2002**

Port pairs	*Net Crane Rate*		*Productivity gap*[a]		*Change in productivity gap*[b]
	1997	2002	1997	2002	
Fremantle	16.7	25.3			
Hamburg	22.8	23.1	-6.1	2.2	8.3
Fremantle	16.7	25.3			
Tilbury	20.4	16.8	-3.7	8.5	12.2
Fremantle	27.4	24.1			
Singapore	25.0	24.3	2.4	-0.2	-2.6
Fremantle	27.4	24.1			
Port Klang	23.0	20.6	4.4	3.5	-0.9

a Negative values in these columns indicate that Net Crane Rates in Fremantle were less than for terminals in the overseas ports with which Fremantle was compared, such that a productivity gap exists. The opposite applies for positive values. **b** Negative values in this column indicate that the productivity gap between 1997 and 2002 has changed, or in this circumstance widened, such that the productivity of Fremantle terminals has deteriorated relative to those in the selected overseas ports.

Source: PC 1998a, AmZ 2003.

Table A4.20 **Net Crane Rate comparisons (container lifts per hour) — Melbourne and selected overseas ports, 1997 and 2002**

Port pairs	*Net Crane Rate*		*Productivity gap*[a]		*Change in productivity gap*[b]
	1997	2002	1997	2002	
Melbourne	23.0	23.7			
Los Angeles	19.9	26.8	3.1	-3.1	-6.2
Melbourne	22.8	24.0			
Philadelphia	29.7	31.3	-6.9	-7.3	-0.4
Melbourne	17.3	20.4			
Hamburg	22.8	23.1	-5.5	-2.7	2.8
Melbourne	17.3	20.4			
Tilbury	20.4	16.8	-3.1	3.6	6.7
Melbourne	25.2	19.8			
Singapore	25.0	24.3	0.2	-4.5	-4.7
Melbourne	25.2	19.8			
Port Klang	23.0	20.6	2.2	-0.8	-3.0
Melbourne	18.6	28.2			
Nagoya	33.0	33.6	-14.4	-5.4	9.0
Melbourne	18.6	28.2			
Pusan	24.0	28.1	-5.4	0.1	5.5

a Negative values in these columns indicate that Net Crane Rates in Melbourne were less than for terminals in the overseas ports with which Melbourne was compared, such that a productivity gap exists. The opposite applies for positive values. **b** Negative values in this column indicate that the productivity gap between 1997 and 2002 has changed, or in this circumstance widened, such that the productivity of Melbourne terminals has deteriorated relative to those in the selected overseas ports.

Source: PC 1998a, AmZ 2003.

B Definitions

The definitions adopted in this study are broadly the same as those used by the BTRE in its *Waterline* publication (BTRE 2002b). These definitions along with comments on their use and interpretation in the study, are described below.

Containers Handled — the total number of containers lifted on/off cellular ships.

Some lines include hatch cover lifts in the number of moves to calculate productivity. However, wherever hatch cover lifts were shown separately by the shipping lines participating in this study, they were deducted to make the data comparable for all participating lines.

Elapsed Labour Time — the elapsed time between labour first boarding the ship and labour last leaving the ship

The following non-operational delays are excluded when calculating elapsed labour time:

- no labour allocated;
- closed-port holiday;
- port-wide industrial stoppages, and
- breakbulk and container handling that require manual interventions such as the use of wires, chains, non-rigid spreaders or other handling gear.

This definition is analogous to total ship hours worked. Although labour may be on board and available to work the ship, it is not the case that cranes are operating during all of this time.

Gross Crane Time — the total number of allocated crane hours

The Gross Crane Time can exceed the Elapsed Labour Time if more than one crane is working a ship.

Elapsed Crane Time — the total allocated crane hours, assuming that the ship is ready for working, less operational and non-operational delays

The following are classified as operating delays:

- no labour allocated;
- closed-port holiday;
- port-wide industrial stoppage;
- total crane time handling break bulk cargoes and containers that require manual interventions such as use of wires, chains, non-rigid spreaders or other handling gear;
- award or enterprise agreement breaks as applicable;
- adverse weather;
- delays caused by the ship or its agent;
- all container crane breakdowns, including spreaders; (T)
- other equipment breakdowns which stop container crane operations; (T)
- booming up for passing ships; (T)
- handling hatch covers; (T)
- cage work and lashing/unlashing where crane operations are affected; (T)
- crane long-travelling between hatches and crossing accommodation; (T)
- labour withdrawn without operator's agreement including enterprise related industrial stoppages; (T)
- over-dimensional containers requiring additional (rigid) spreader changes; (T)
- waiting for export cargo; and
- delays caused by defective ship's gear such as jammed twist-locks, broken cell guides, ballast pumps unable to maintain trim, and so on.

The Elapsed Crane Time is an approximation of the time that cranes actually work a ship.

Some shipping lines do not accept as unavoidable, certain deductions from actual crane operating times. These deductions relate to delays for activities that the shipping lines believe are under the control of terminal operators, such as spreader changes. These changes are marked above with (T).

Gross Crane Rate — the total containers handled divided by the Gross Crane Time

The Gross Crane Rate is a measure of the performance of the terminal operation as delays under the control of the terminal operator and shipping lines are not subtracted.

Net Crane Rate — the total containers handled divided by the Elapsed Crane Time.

The Net Crane Rate is called the 'Crane Rate' by the BTRE. The Net Crane Rate (after deduction for the delays listed under the definition of Elapsed Crane Time) is a measure of the productivity of labour at the terminal.

For this study, this measure is expressed as container lifts per hour. However, it is also expressed by others as the total Twenty-foot Equivalent Units (TEUs) handled divided by the Elapsed Crane Time.

Gross Ship Rate — the total number of containers handled divided by the Elapsed Labour Time

Some shipping lines prefer to use Gross Ship Rate rather than the Net Ship Rate to measure the efficiency of terminal operators. Unlike the Net Ship Rate, the Gross Ship Rate is not dependent upon the definition and measurement of delays. Different ports and terminals can use different measures and definitions for operational and non-operational delays, work times and handling rates.

Further, the Gross Ship Rate is the measure that is most directly related to the time that it takes to turn a ship around at the terminal.

Crane intensity — the total number of allocated crane hours, divided by the elapsed time from labour first boarding the ship and labour last leaving the ship less certain operating delays

The following are classified as operating delays:

- no labour allocated to the ship;
- closed port holiday; and
- port-wide industrial stoppage.

Crane intensity allows for the possibility that more than one crane might work the ship.

Net Ship Rate — the Net Crane Rate multiplied by the Crane Intensity

Shipping lines are mainly interested in the turn-around time for their ships. This is influenced by crane intensity or the number of cranes working the ship and not just individual crane productivity.

The Net Ship Rate takes into account the availability of more than one crane to work a ship and the performance of the terminal operations as a whole in turning around a ship in the minimum time.

References

AmZ Limited 2003, *International Benchmarking of Container Handling Rates and Charges*, Consultant report to the Productivity Commission, February.

ACCC (Australian Competition and Consumer Commission) 2002, *Container Stevedoring*, Monitoring Report No. 4, October.

ANAO (Australian National Audit Office) 2000, *Administration of the Waterfront Redundancy Scheme*, AusInfo, Canberra.

BTE (Bureau of Transport Economics) 1986, *Shore-based Shipping Costs, Non-Bulk Cargo*, Occasional Paper 80, AGPS, Canberra.

BTCE (Bureau of Transport and Communication Economics) 1995, *Review of the Waterfront Industry Reform Program*, Report 91, AGPS, Canberra.

BTRE (Bureau of Transport and Regional Economics) 2002a, *Australian Sea Freight, 1999-2000*, Information Paper 47, Canberra.

—— 2002b, *Waterline*, Issue no. 33.

—— 2003, *Waterline*, Issue no. 34.

Containerisation International 2002, *Containerisation International Yearbook 2002*, National Magazine Co Ltd, National Magazine House, London.

Hein, R. 2000, *Interview on 9 July 2000 with Richard Hein*, CEO of P&O Ports Australia, http://businesssunday.ninemsn.com.au/business (accessed on 3 October 2002).

PC (Productivity Commission) 1998a, *International Benchmarking of the Australian Waterfront*, Research Report, AusInfo, Melbourne.

—— 1998b, *Work Arrangements in Stevedoring*, Research Report, AusInfo, Melbourne.

RIRDC (Rural Industries Research and Development Corporation) 2002, *Benchmarking Technology on the Australian Waterfront, Implications for Agricultural Exports*, http://www.rirdc.gov.au.

TCS (Thompson Clarke Shipping Pty Ltd) 1997, *International Benchmarking Study of the Australian Waterfront, Part A Report*, Consultant Report to the Productivity Commission.