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An investigation of best practice landside efficiency at Australian container ports

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Abstract

The National Ports Strategy proposed by Infrastructure Australia and the National Transport Commission has special focus on landside efficiency of ports. One of its recommendations is that BITRE should conduct and publish research into best practice arrangements for the landside efficiency of ports. This paper describes some of the economic issues that arise from the way container ports in Australia are organised. Among other things, the paper points to the need for better balancing of competitive strengths of, and the enhancing of cooperation between, companies operating in Australian container ports.

Landside of a port includes the space within the gates of the port and the port's hinterland. Within the gates of a port, efficiency refers to the speed of processing containers measured by container turnaround times, truck turnaround times, and container dwell time–the length of time a container spends at port. Over the port's hinterland interest is in the cost and optimality of the mode used to move a container to and from the terminal and is measured by indicators like cost per container; rail mode share; and the efficiency of truck utilisation.

The paper discusses five areas:

- Management of peak demand for container pick up and drop off;
- Truck turnaround times;
- Congestion in the port's hinterland;
- Rail's mode share in container haulage.

Efficiency at both the wharf-side and land-side of a container port terminal is important since ports are economic 'gates' for a country's exports and imports.

Keywords: Landside of port, efficiency, containers.

1. Introduction

This paper discusses possibilities of doing more with existing infrastructure at Australia's port terminals. The paper starts by summarising the key features of the landside (including the hinterland) at Australian container ports. It describes stakeholders at Australian port terminals, the power relationships between the stakeholders and the economic power of individual stakeholders—for example, are they price takers or do they have capacity to influence prices for port terminal services?

The main part of the paper reviews Australian and overseas literature in a discussion of how differences in pricing and other instruments appear to lead to differences in a number of landside equilibrium values for: the management of peak demand for container pick up and drop off; truck turnaround times; congestion at the port and in the port's hinterland; and rail's mode share in container haulage.

The last section of the paper makes some concluding remarks.

The paper provides a synthesis of recent, scattered studies of Australia's container ports and places these results side by side to data on selected overseas ports and enables a qualified comparison of landside efficiency between Australian and overseas ports. An important qualification is that the comparisons do not control for port size.

2. Characteristics of the landside of Australia's container ports

2.1 Throughput

Table 1 shows that, in 2009-10, the top six container ports handle 97 per cent of container movements in Australia. Thus container handling in Australia is strongly concentrated.

Table 1 Twenty foot equivalent units (TEUs) handled at Australian ports, 2009-10

Australian port-State/ Territory	Imports	Exports	Total	Cumulative
		TEUS		Per cent
Melbourne –Vic	1 133 056	1 103 577	2 236 633	35.3387
Sydney – NSW	976 215	951 292	1 927 507	65.7932
Brisbane – Qld	463 129	455 869	918 998	80.3133
Fremantle- WA	288 463	268 980	557 443	89.1209
Adelaide-SA	137 398	137 103	274 501	93.4580
Burrnie – Tasports	104 307	107 690	211 997	96.8075
Devonport – Tasports	40 828	38 911	79 739	98.0674
Bell Bay – Tasports	19 254	21 280	40 534	98.7078
Townsville-Qld	17 007	18 448	35 455	99.2680
Newcastle- NSW	5 195	8 029	13 224	99.4770
Cairns-NT	5 180	5 042	10 222	99.6385
Darwin-NT	4 888	4 040	8 928	99.7795
Esperance-WA	3 422	2 085	5 507	99.8665
Thursday Island-Qld	2 651	2 737	5 388	99.9517
Port Kembla –NSW	957	1 157	2 114	99.9851
Port Alma-Qld	458	94	552	99.9938
Gladstone-Qld	0	201	201	99.9970
Port Hedland-WA	109	0	109	99.9987
Broome-WA	50	0	50	99.9995
Eden-NSW	2	31	33	100.0
TOTAL	**3 202 569**	**3 126 566**	**6 329 135**	**Not applicable**

Source: Ports Australia (2011)

Efficiency outcomes at each of the container ports are dependent on a complex web of decisions made by business and regulatory bodies.

2.2 Stakeholders

Table 2 summarises some the stakeholders in Australia's export and import container logistic chains. These stakeholders form part of the institutional environment at each of the ports.

2.2.1 Port authorities

All five major container ports are managed and developed by a single port authority. Three of them are state-owned and two of them are private. Each port authority is thus a 'natural monopoly' in its area of operation.

Port of Melbourne Corporation, Victorian state government owned, was established by the Victorian Government in 2003 to be the strategic manager of the Port of Melbourne. It owns

all the land within the port boundaries and has powers and functions to undertake an integrated development of the water and land side of the port. It is also the Vessel Traffic Service Authority and thus it governs all vessel movements through the port waters.

Sydney Ports Corporation is a NSW State Government owned corporation that manages Sydney Harbour, Port Botany Bay and other ports in the Sydney region. Sydney Ports Corporation manages and develops port facilities and services. It also manages the navigational, security and operational safety needs of commercial shipping.

Table 2 Major economic stakeholders of major Australian container ports

	Stakeholder	Melbourne	Sydney	Brisbane	Fremantle	Adelaide
1	Port Authorities	1	1	1	1	1
	Port Authority no of employees	246	300	300	306	100*
	Ownership	State-owned	State-owned	Private	State-owned	Private
	Number of container berths	8	9	7	6	2
2	Container stevedores	2	2	2	2	1
3	Shipping container lines / year	37	20	40	23	7
4	Empty container parks	10	6	3	4	1
5	Metropolitan and regional intermodal terminals	1	5	1	1	1
6	Customs brokers / Freight forwarders	82	119	61	43	23
7	Train operators	3	6	3	2	?
8	Road operators	107	350	26	11	?
9	Resident community in the port's hinterland	Port Phillip LGA	Botany Bay LGA	Brisbane LGA	Fremantle LGA	Port Adelaide Enfield LGA
	Area (Square Km)	20.7	21.7	1326.3	19	91.8
	Population (2009)	96110	39664	1052458	28105	111455
	Total business (2007)	16221	4203	103599	678	7215
10	Local government	Port planning; Land development and road use decisions				
11	State/ Territory Governments	Port planning; High level control of ports; opening hours for container yards, etc				
12	Commonwealth government	Port planning, Safety; national security, defence, competition (ACCC) border management, transport security; infrastructure funding				

*Relates to Flinders Ports as a whole; LGA = Local Government Area

Source: Ports Australia (2011), these websites of port authorities <http://www.portbris.com.au/>, <http://www.sydneyports.com.au/>, <http://www.portofmelbourne.com/>, http://www.fremantleports.com.au/, http://www.flindersports.com.au/portfacilities2.html.

The source for local the community are data cubes from ABS website: www.abs.gov.au.

The Port of Brisbane, privatised in 2010, is managed and developed by the Port of Brisbane Pty Ltd (PBPL), under a 99-year lease from the Queensland Government. PBPL is owned by the Q Port Holdings (QPH) consortium, comprising four infrastructure investors-- Global Infrastructure Partners; Industry Funds Management; QIC Global Infrastructure; and Tawreed Investments Ltd, a wholly-owned subsidiary of the Abu Dhabi Investment Authority.

The container port terminal is managed by Fremantle Ports, a Western Australian Government trading enterprise. The Inner Harbour at Fremantle handles almost all of the container trade for Western Australia. Fremantle Ports provides and maintains shipping

channels, navigation aids, cargo wharves at common user areas and leased terminals, road and rail transport infrastructure in the port area, and other port infrastructure such as storage sheds, water, power and public amenities.

This is one of seven ports in South Australia operated by Flinders Ports. The seven ports are Port Adelaide, Port Lincoln, Port Pirie, Klein Point, Port Giles, Thevenard and Wallaroo. Flinders Ports is a private sector entity with 71.4 per cent of the shares held (in equal proportions) by Motor Trades Association of Australia Superannuation Fund Pty Limited and Galaxy S.A.R.L, and the balance of shares held by Local DIT Investments Pty Ltd, Equipsuper Flinders Ports Holdings Pty Ltd and Equipsuper Pty Limited.

Each of the port authorities has monopoly power which derives from ports being natural monopolies. Each one of the port authorities is a stevedore-centric profit maximizing land lord. The features of a land lord port authority include (Van Der Lugt and De Langen 2000):

The development, management and control of the port area; and

Provision of port infrastructure for safe access to the port by vessels.

Van Der Lugt and De Langen (2000) argue that this delineation of responsibility is a choice that port authorities make. Van Reeven (2010) points out that for port authorities this is a profit maximising choice but one that leads to higher charges to port customers and higher levels of externalities (for example, congestion in the port's hinterland) on third parties than would result under more competitive situations.

2.2.2 Container stevedores

At Adelaide, DP World is a sole stevedoring company at the port terminal. Patrick and DP World form a duopoly at the Brisbane, Sydney, Melbourne, and Fremantle container ports. However, in 2011-12 a third stevedore- Hutchison Port Holdings- will start operating in Brisbane and Sydney. DP World and Patrick each control about half the market for stevedoring services in Australia. The industry earns supernormal profits (NTC 2008). For example, industry profitability increased from 17.63 per cent in 2007-08 to 18.39 per cent in 2008-09 (ACCC 2010a).

2.2.3 Shipping lines

There are a few (about 40) shipping lines that service Australian container ports. Each container port is a small part of the many international shipping line's Australian and world-wide operation. Most shipping lines own containers. Shipping lines are the lead participants in Australia's international container supply chain mainly because nearly all Australia's import and export containers are carried by sea (NTC, 2008 p 33). They can and do exert some degree of influence on stevedores and container parks operators.

2.2.4 Empty container yards operators

The majority of these are owned by and operated under contract on behalf of shipping lines. Park services include empty container handling and storage for containers, cleaning, repairs and food-quality upgrades repositioning empty containers to terminals and interconnecting with rail facilities for intra and interstate services.

2.2.5 Intermodal terminal operators

Intermodal terminals facilitate the transfer of containers between transport modes, allowing the most appropriate transport mode to be selected for different segments of the container's trip between the port terminal and importer or exporter. There is a mix of metropolitan and regional intermodal terminals. Table 2 shows estimates of the numbers of these in the five

capital cities. Intermodal terminals operate under an oligopolistic (small number of sellers) market structure (NTC, 2008).

2.2.6 Australian Maritime Union

MUA claims to represent around 12,000 Australian men and women - stevedoring workers and other maritime staff. They play a key role in negotiating terms and conditions for stevedoring workers.

2.2.7 Customs brokers / freight forwarders

Customs brokers 'clear' goods through customs for importers and exporters. This involves the preparation of documents and/or electronic submissions, the calculation (and usually the payment) on behalf of the client of taxes, duties and excises, and facilitating communication between the importer/exporter and governmental authorities. Customs brokers may be employed by or affiliated with freight forwarders, but may be independent businesses or may be employed by shipping lines, importers or exporters.

Historically, customs brokers and freight forwarders in major Australian ports did not establish large intermediary companies (trading houses) which own cargo handling facilities (yards, storage, lifting, fleet, etc), which would allow them to take risks and earn profits from their extended services. The corresponding numbers in Table 2 include a few larger size companies but many of them are small agencies. De Langen (2009, page 117) points out that small companies generally lack adequate resources for investment in port infrastructure, and may represent co-ordination problems for port authorities. An imbalance in economic power among companies may not contribute to the overall competitiveness of ports. Private operators are motivated by profit maximization objectives. “They may not necessarily provide facilities or services that are of economic, environmental or social value if doing so would conflict with profit maximization. This creates the need for regulatory oversight to ensure that the public interest is upheld” (World Bank, 2001, module 6, page 4).

It is therefore a common practice that port authorities manage such externalities and include them in the contracts (obligations) of other participating companies or manage them themselves.

2.2.8 Rail operators

There are a number of train operators involved in moving containers through four of the five major container ports. However the share of rail in moving containers remains relatively low throughout all container ports. There is however, a NSW government target for rail share in movement of containers of 40 per cent at Port Botany and a Victorian government target for rail share of 30 per cent at the Port of Melbourne

2.2.9 Container truck companies / logistic handlers

Road has always been the dominant transport mode for moving freight to and from the five major Australian container ports. According to available data on container truck companies there is intense competition in this market. For example, in Sydney about 350 road transporters made up of 250 regular trucking firms which subscribe to the two stevedores vehicle booking system at Port Botany and a further 100 road transporters who drop off or pick up containers at the port irregularly (IPART, 2008). Though the number of operators is large there is significant concentration. For example at Port Botany the largest 25 road transport companies carry 50 per cent of containers moved by road and the smallest 100 carry 4 per cent of the road hauled containers.

There are many trucking companies servicing Australian container ports, especially in Sydney and Melbourne. Many of these own one or a few trucks providing trucking services on demand. Trucking services are contracted in a similar way to the hiring of temporary port labour when needed at peak periods. This approach is inefficient. Trucking operators waste time in queues at port gates and increase congestion at peak times, when they get most of

their jobs. The waiting time is paid for by importers and exporters who pass them on to consumers in form of higher prices for goods.

2.2.10 Hinterland residents

Residents in the local government areas in the neighbourhood of ports are important stakeholders in the container port business. While some of them may not be clients of the port terminal, they are all impacted to varying degrees by increased congestion and traffic when the number of freight vehicles increase. Their representatives on local governments or councils impact on the container freight sector because they set the ordinances, rules, restrictions and regulations regarding, among other issues, opening hours of businesses, permissible noise levels and permitted vehicle weights. These ordinances, rules, restrictions and regulations have an impact on the cost of transport per container and how much time it takes to deliver a container from a port to a consumer or importer and from an exporter to the port terminal.

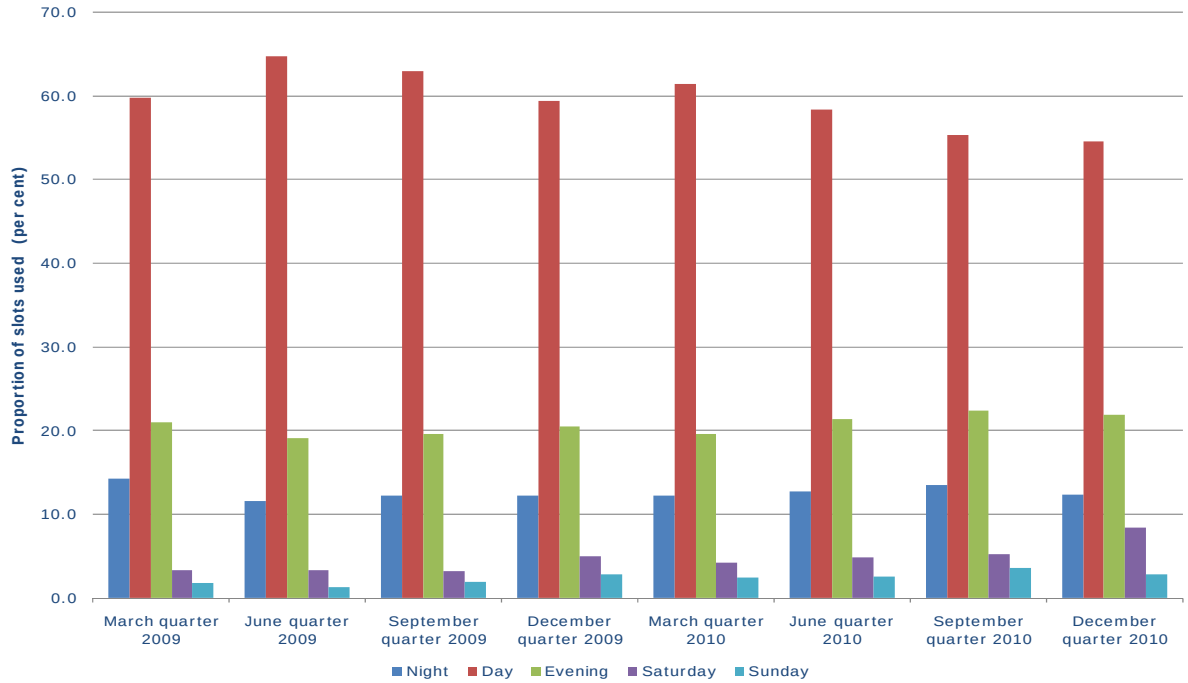
3. Sources of port terminal efficiency improvements at the landside of port terminals

This section discusses five areas of relevance to landside of port terminal efficiency: management of peak demand for container pick up and drop off; truck turnaround times; congestion at the port and in the port's hinterland; and rail's mode share in container haulage. The discussion is based on a review of overseas and Australian literature on the landside efficiency of container ports.

3.1 Management of peak demand for container pick up and drop off

On the landside of Australia's five major container ports 50 to 65 per cent of containers picked up by way of the stevedores' vehicle booking system (VBS) are picked up during the day time when the road network is busiest with non-port traffic. About 20 per cent of VBS slots for trucks during week day afternoons, night time and on weekends are currently used (Figure 1). Using more intensively these shifts away from the congested day-time window would reduce congestion around ports and on adjoining roads, especially at peak demand times. At the same time, reducing the traffic density around ports could mean postponement of investment to extend road and port infrastructure around port gates and adjoining areas.

Figure 1: Five ports: Vehicle booking system slots usage by day and time of week



Source: BITRE, 2011; Waterline 49.

The Southampton Container Terminal (in UK) is reported to have succeeded in cutting congestion at and around the port through the introduction of IT systems coupled with peak pricing for trucks access to the port. Trucks are charged British Pound £ 1 and £ 25 for no shows. The small peak period charge of £ 1 is reported to have led to a spread in the peak (European Conference of Ministers of Transport 2007).

In 2005 the terminal operators at the Ports of Los Angeles and Long Beach set up PierPass, the administrative organization which collects fees charged per TEU that is picked up or delivered to the terminal during daytime weekday hours. The initial fees in 2005 was $US 40 per TEU and was increased to $US 50 per TEU in 2006. The fees are used to finance the labour, operational and administrative costs of the OffPeak night gate and Saturday gate operations at the two ports.

For terminal operators, the program has been successful. In 2005 before PierPass 10 to 15 per cent of containers were being moved at off-peak hours. In 2006 the percentage of containers moved at off-peak hours increased to 33 (Connor, 2006). In 2011 about 50 per cent of containers were being moved at off-peak hours (Porter 2011) but with PierPass making a loss of about $US 75 million.

At Port Botany Bay there is a preference for using the stevedores' vehicle booking system to even out the demand for slots. Peak period pricing has not been tried at the port or any other container port in Australia. However, as the US experience shows it offers an untapped source of potential improvement to landside efficiency.

3.2 Truck turnaround times

One measure of efficiency at the landside of port terminal is a measure of how long it takes a truck from the time it arrives at the port terminal to the time the truck exits the port terminal. Table 3 shows some estimates. The estimates for the Ports of Los Angeles and Long Beach are median times. Thus half of the trucks measured spend 31 minutes from the time of entry into the port terminal to the point of exit. The estimates for Australian container points are averages. Caution needs to be exercised in comparing the estimates across container ports because the estimates come from different distributions and are based on samples of differing sizes.

Under the Port Botany Landside Improvement Strategy (PBLIS) regulations implemented from February 2011, stevedores who keep truck carriers waiting in queues will be forced to pay penalties. For example, stevedores that fail to meet the truck turnaround time (total visit time) standard – 50 minutes for the first container and then 15 minutes for each additional container – will be fined $100 per truck per hour. At Port Botany the penalties imposed on stevedores if they work will achieve turn-around times equivalent to the median times at the Ports of Los Angeles and Long Beach achieved by use of peak pricing as the instrument.

The Southampton Container Terminal (in UK) using instruments discussed above is reported to have reduced waiting times from an average of 4 hours to 30 minutes (European Conference of Ministers of Transport 2007).

Table 3: Turnaround times at selected Australian container ports and at the Ports of Los Angeles and Long Beach (LA/LB

Time spent	Ports of LA/LB	Melbourne	Sydney	Brisbane	Fremantle	Adelaide
	Oct 2010(a)	Dec Q 2010(b)	Dec Q 2010(b)	Dec Q 2010(b)	Dec Q 2010(b)	Dec Q 2010(b)
	Minutes (Median)		Minutes (Average)			
Waiting outside the gate	20	‘nm	Nm	nm	Nm	nm
From entry gate to exit gate	31	25.9	45.5	32.9	34.6	41.4
Total visit time	51	‘nm	Nm	nm	Nm	nm
Number of trucks	250	221 538	143 299	64 609	25 134	56 703

nm = not measured; Dec Q is the December quarter.

(a) Estimates are from a study that used GPS tracking installed in a sample of 250 trucks to measure truck queuing and terminal visit times at the Ports of Los Angeles and Long Beach.
(b) Provided by DP World and Patrick based on data on trucks that use the stevedores’ vehicle booking system

Source: Truck Turn-Time Stakeholder Group (2011), BITRE (2011)

3.3 Congestion at the port and in the port’s hinterland

IPART (2008) described the relationship between Port Botany and Sydney congestion:

> The movement of trucks in and out of Port Botany contributes to traffic congestion on Sydney's roads generally. The congestion problems go well beyond the stevedores' facilities—they also affect the wider metropolitan road network, when trucks share the roads with commuters at peak times.

A similar relationship exists between port terminal traffic and traffic at other metropolitan cities with significant container port terminal traffic. According to BTRE (2007) congestion in the five cities where the major container ports are based is projected to increase as shown in Table 4. The contribution of rigid and articulated trucks to total vehicle kilometres travelled in each of the metropolitan areas is small and rising, but is projected not to exceed 6 per cent by 2020. However, the contribution of these trucks to vehicle kilometres travelled in the neighbourhood of container ports is likely to be higher than the metropolitan average share in Table 4.

Container movements in an Australian city contribute to congestion in that city. Container movements in an Australian city contribute to congestion in that city. For example, Port of Melbourne Corporation (2010) in its study of 2009 container logistics chain in Melbourne found that:

> 87 per cent of international and mainland costal containers imported through the Port of Melbourne are delivered to destinations located in the metropolitan area; and
>
> 54 percent of export containers through the port of Melbourne originate from metropolitan Melbourne.

Similarly the Sea Freight Council of New South Wales (2004) found that Sydney's industrial suburbs of Bankstown, Parramatta, Fairfield, Blacktown and Campbelltown account for 70 per cent of full import containers and 34 per cent of full export container movements.

Table 4: Base case projections for average network delay due to congestion for Australian metropolitan areas: 2005, 2010, 2015 and 2020.

Year	Melbourne		Sydney		Brisbane		Perth (Fremantle)		Adelaide	
	Min/km	Trucks VKT (%)	Min/km	Trucks VKT (%)	Min/km	Trucks VKT (%)	Min/km	Trucks VKT (%)	Min/km	Trucks VKT (%)
2005	0.335	4.0	0.350	4.7	0.286	4.6	0.261	4.1	0.283	3.2
2010	0.399	5.0	0.421	4.8	0.352	4.7	0.315	4.2	0.330	3.3
2015	0.445	5.2	0.475	4.9	0.407	4.7	0.359	4.2	0.363	3.4
2020	0.488	5.6	0.527	5.0	0.464	4.9	0.402	4.4	0.393	3.6

Min/km = minutes per vehicle kilometre travelled in the city.

Trucks VKT (%) is the sum of vehicle kilometres travelled by rigid trucks and articulated trucks as a percent of total vehicle kilometres travelled by all road vehicles in the city

Source: BITRE (2007 Tables 2.2, 2.3, 2.4, 2.5, 2.6 and 2.12)

Table 5 shows the number of trucks handled at each of the container ports in the recent four years for which data is available. For most quarters 55 per cent to 70 per cent of these trucks access the container ports during the day peak period.

Table 5: Number of trucks processed at Australia's five major container ports: 2007 to 2010

Year	Melbourne	Sydney	Brisbane	Fremantle	Adelaide
2007	743 499	510 795	296 300	211 041	78 829
2008	799 740	536 072	298 845	226 443	88 579
2009	717 183	493 309	265 582	206 498	79 061
2010	837 926	551 553	257 106	213 605	90 703

Note: The counts in the table are minimum counts. They include trucks processed through the stevedores' vehicle booking system and trucks used for bulk runs but not those that do not access the port through the VBS.

Source: BITRE (2011) and earlier issues of the BITRE Waterline journal

The Ports of Los Angeles and Long Beach used the PierPass scheme described to shift container movements to the off-peak window thereby reducing the number of truck trips during the peak period by an estimated 15 000 trips per day (Potter, 2011) with significant impacts on delay times for other peak period road users.

The Australian Port of Fremantle obtained permission from the Australian Competition and Consumer Commission, ACCC (2010b), for 5 years up to July 2015, for DP World Australia Limited and Patrick Stevedores Operations Pty Ltd to give preferential treatment to truck carriers engaging in dual runs (where a truck both delivers and collects a container in a single trip) at the Port of Fremantle. The proposed arrangement is a government and industry initiative, intended to address the problem of road congestion at the Port of Fremantle and its effect both on the efficiency of the port's operations and on the surrounding community.

The ACCC accepted that the proposed arrangement is likely to: increase the efficiency of the Port of Fremantle; reduce the number of trucks moving to and from the port, to the benefit of the surrounding community and the environment and create a public benefit that outweighs any public detriment.

The arrangement does not allow DP World and Patrick to agree on the price or the number of slots they make available at their terminals for booking by truck carriers. Authorisation provides immunity from court action for conduct that might otherwise raise concerns under the competition provisions of the Trade Practices Act 1974.

3.4 Rail's mode share in container haulage

IPART (2008) argues that the low mode share of rail in container transport is due to poor coordination, absence of investment in rail and to an assessment that at present the rail service is not sufficiently reliable to meet the needs of many of its potential clients. Targets have been set for the share of rail in container haulage to and from container port terminals in New South Wales (Freight Infrastructure Advisory Board NSW 2005) and Victoria (Department of Infrastructure, Victoria 2006). Table 6 summarises the mode shares for the three largest container ports for the three years to 2010 and shows that for the ports where there are targets, estimated mode shares fall short of the targets..

Table 6: Road versus rail in the haulage of containers on the land side of port terminals

	Melbourne			Sydney			Brisbane		
	2008	2009	2010	2008	2009	2010	2008	2009	2010
	Per cent			Per cent			Per cent		
Road	96.1	94.1	95.1	80.6	78.1	82.7	91.4	91.6	92.6
Rail	3.9	5.9	4.9	19.4	21.9	17.3	8.6	8.4	7.4
Rail target	**30.0**	**30.0**	**30.0**	**40.0**	**40.0**	**40.0**	**'na**	**'na**	**'na**
	No of Containers			No of Containers			No of Containers		
Total	1417445	1310624	1433547	1162066	1091564	1220187	629546	554264	600736

Note: There are no rail facilities at Adelaide and Fremantle; na= not applicable.

Source: BITRE (2011) based on data provided by stevedores DP World and Patrick.

In Netherlands at the Ports of Rotterdam the share of rail in container transport was only 8 per cent in 2002 (de Langen and Chouly, 2004). However, by 2005 rail share had grown to 9.3 per cent and was projected to be 20 per cent by 2035. One explanation for this growth in mode share in container freight for rail is investment in rail infrastructure. In 2007 the Euromax rail terminal on the Maasvlakte in the Port of Rotterdam was opened with a capacity of 3.2 million TEUs. Furthermore, the port has a dedicated railway line, freely accessible to all.

4. Conclusions

This paper discusses examples of best practice in landside of port efficiency at Australian and overseas container ports focusing on four areas: the management of peak demand for container pick up and drop off; truck turnaround times; congestion at the port and in the port's hinterland; and rail's mode share in container haulage.

In the first three areas improvements overseas have been achieved at port terminals by using well-designed pricing and related instruments. The most notable overseas example is the success at Los Angeles/ Long Beach container ports in California where 50 per cent of the daily demand for truck trips was shifted to the off peak time window by use of pricing. In Australia, the demand for truck trips during the day time peak ranges from 55 percent in most quarters to under 70 percent of total daily demand (Figure 1). Thus there seems to be room for improvement at Australian ports.

The paper also indicates that the market structures under which many of the services at container ports are produced tend to be monopolies or duopolies or at best to display monopolistic competition. Port efficiency requires balance of economic strength among participating companies. Therefore continuous improvement of Australian ports requires that the internal workings and institutional arrangements at these ports be critically analysed from time to time.

References

Australian Competition and Consumer Commission (2010a) *Container stevedoring monitoring report* no 12 ACCC Canberra

Australian Competition and Consumer Commission (2010b) DP World Australia Limited & Patrick Stevedores Operations Pty Limited - Authorisations - A91238 - A91240 viewed on 1 June 2011 at < http://www.accc.gov.au/content/index.phtml/itemId/936500>

ACCC see Australian Competition and Consumer Commission

Bobrovitch D (1982) Decentralised planning and competition in a national multi-port system. *Journal of Transport Economics and Policy*, January 1982

BITRE, see Bureau of Infrastructure, Transport and Regional Economics

BTRE see Bureau of Transport and Regional Economics

Bureau of Transport and Regional Economics (2007) *Estimating urban traffic and congestion cost trends for Australian cities*. BTRE Working Paper 71, Canberra

Bureau of Infrastructure, Transport and Regional Economics (2011) *Waterline* 49, Canberra, ACT

Cheon S (2007) Evaluating Impacts of Institutional Reforms on Port Efficiency Changes: Malmquist Productivity Index for World Container Ports", submitted for 2nd Annual National Urban Freight Conference in Long Beach, California

CLAG see Container Logistic Action Group

Connor S J (2006) PierPass increases traffic mitigation fee to $50 per TEU viewed on 1 June 2011 at < http://www.jsconnor.com/news/march_21_2006.htm >

Container Logistic Action Group (2007) Submission to 'Reforming Port Botany' links with inland transport: Review of the interface between the land transport industries and the stevedores at Port Botany 6 June 2007 Sydney

De Langen P.W (2009) *Assuring Hinterland Access: the role of port authorities, International Transport Forum: Port competition and hinterland connections, Round table 143*, OECD/ITF 2009

Department of Infrastructure, Victoria (2006) *Improving rail mode share at the port of Melbourne, Final report* prepared by Booz, Allen and Hamilton for the Department of Infrastructure, Victoria, Melbourne

De S and Dutta D (2007) Impact of intangible capital on productivity and growth: lessons from the Indian information technology software industry *The Economic Record* Vol 83 Special issue September 2007 pp S73-S86

De Borger B and De Bruyne D (2011) Port activities, hinterland congestion and optimal government policies: The role of vertical integration in logistic operations *Journal of Transport Economics and Policy,* volume 44 part 2 May 2011 pp 247-275

de Langen P W and Chouly A (2004) Hinterland access regimes in seaports *European Journal of Transport and Infrastructure Research*, Volume 4, No 4, pp 361-380

European Conference of Ministers of Transport (2007) *Policy responses to congestion: pricing Submitted to the SOFIA ministerial meeting 2007*, International Transport Forum

Fang X and T Zhu (1999) Institutional imperfection and transition strategies *Economic Systems* vol 23 No 4 December 1999 pp 331-348

Freight Infrastructure Advisory Board NSW (2005) Railing Port Botany's containers: Proposals to ease pressure on Sydney roads, viewed on 1 June 2011 at

<http://www.planning.nsw.gov.au/plansforaction/pdf/fiab_report.pdf>

Independent Pricing and Regulatory Tribunal of New South Wales (2008) Reforming Port Botany's links with inland transport Review of the interface between the land transport industries and the stevedores at Port Botany: Other industries Final report

Infrastructure Australia and National Transport Commission (2010) *National Ports Strategy: Infrastructure for an economically, socially, and environmentally sustainable future*, viewed on 1 June 2011 at

<http://www.infrastructureaustralia.gov.au/gateways/files/National_Ports_Strategy_DEC2010_v2.pdf >

IPART see Independent Pricing and Regulatory Tribunal of New South Wales

National Transport Commission (2008) Capacity constraints and supply chain performance —intermodal: Understanding the intermodal supply chain Working Paper 1 prepared by Booz and Company for NTC

Notteboom T (2009) The relationship between seaports and the intermodal hinterland in light of global supply chains: European challenges; in Port competition and hinterland connections Round Table 143, International Transport Forum, OECD

Port of Melbourne Corporation (2010) *Port of Melbourne and Dynon Rail Terminals 2009 container logistics chain study full report*: Port of Melbourne Corporation Melbourne

Ports Australia (2011) Containerised trade in TEU for 2009-10 viewed on 1 June 2011 at

< http://www.portsaustralia.com.au/tradestats/?id=5&period=10 >

Potter J 2011 PierPass boss calls for scheme to pay its way Lloyd's List DCN, April 7, 2011

Rochet Jean-Charles and Tirole Jean (2004) Two-Sided Markets: An Overview March 2004 viewed on 28 April 2011 at<http://faculty.haas.berkeley.edu/hermalin/rochet_tirole.pdf>

Sea Freight Council of New South Wales (2004) New South Wales import export container mapping study Report prepared by Jays Corporate Services, February 2004

Truck Turn-Time Stakeholder Group (2011) Study measures truck turnaround times at Port of Los Angeles and Long Beach Viewed summary on 1 June 2011 at <http://www.eyefortransport.com/content/study-measures-truck-turnaround-times-port-lalb>

van Der Lugt L M and De Langen P W (2000) Port authority strategy beyond the landlord: a conceptual approach Viewed on 1 June 2011 at

< http://www.porteconomics.nl/docs/port_authority.pdf>

van Reeven P (2010) The effect of competition on economic rents in seaports *Journal of Transport Economics and Policy*, volume 44 part 1, January 2010 pp 79-92

World Bank (2001) World Bank port reform tool kit Module 6: Port regulation module

< http://www.docstoc.com/docs/19596088/Port-reform-tool-kit---The-world-bank >