THE IMPACT OF WHARFAGE COSTS ON VICTORIA'S EXPORT-ORIENTED INDUSTRIES

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ABSTRACT

The objective of the paper is to assess the role of wharfage charges in the overall transport chain for Victoria's export industries, and quantify the effects, if any, on trade through the Port and its welfare implications of a reduction in wharfage (i.e. cargo-based) costs. There seems to be an implicit assumption that a reduction in the Port of Melbourne Authority charges on exports, ceteris paribus, will lead to an increase in exports and thus, generate more revenue for the PMA, as well as the Victorian economy.

Using a trade model from which relevant price elasticities were derived and a partial equilibrium framework, the likely trade impact and welfare implications for the PMA and Victorian export-oriented industries were estimated.

The study concludes that any reduction in wharfage will not have a significant effect on Victoria's level of exports on an aggregated level. However, on an industry basis the trade impact could be quite significant depending on the relative importance of the PMA's wharfage charges in an industry's cost structure. From the PMA's viewpoint a reduction in wharfage per se will result in a revenue loss. The study proposes a more discriminatory approach to pricing in which wharfage rates may be varied between commodities, rather than the existing wharfage arrangement based on cargo-pack types which seems to be less effective in encouraging exports.

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INTRODUCTION

There is an implicit assumption within the Port of Melbourne Authority (PMA) that, by having lower wharfage (i.e. cargo-based) rates on exports relative to imports, it can generate more export earnings for the Victorian economy, as reflected in the following statement:-

> "Consistent with the general thrust of the Economic Strategy on encouraging and promoting export industries, the level of Port of Melbourne Authority charges will not rise relative to those for imports for the foreseeable future".
>
> [Victoria: The Next Decade (1987, p.225)].

The main objective of the paper is to verify the above assumption, i.e. to assess the role of PMA's wharfage charges in the overall transport chain, and quantify the trade effects, if any, of a reduction in wharfage charges. Secondly, an attempt is also made to test the revenue neutrality assumption and welfare implications, particularly for Victorian exporters, resulting from a wharfage reduction.

The first section considers the linkages between the Port of Melbourne and Victoria's export-oriented industries in terms of the volume of export commodities passing through the Port, and their inter-dependence in terms of inputs required in their production process. The second section examines the wharfage charges in relation to other cost components in the transport chain. The third section evaluates the trade and welfare benefits that might be gained from a wharfage reduction from the viewpoint of the PMA and Victorian exporters at the aggregated and disaggregated level, and the analysis concludes with a brief summary of policy implications.

I. PORT DEPENDENCE BY INDUSTRY IN VICTORIA

In volume terms, Victoria's sea ports handle virtually all Victorian exports. Air transport handles less than one percent of export volume. However, because air transport tends to concentrate on high value goods its share of export values is much greater at 13.6%.

Total export cargo that originated and loaded in Victoria in 1987/88 amounted to 12.3 million tonnes valued at A$8999.2 million. A breakdown of this outward cargo movement by ports shows that in 1987/88 33.2% of the total volume of Victoria's export cargo was loaded at the Port of Melbourne. In value terms, the Port of Melbourne accounted for 80.5% of Victoria's overall export trade (being mostly non-bulk, containerised cargo).

The main direct users of the Port in the export process are the shipping lines/agents, stevedores/berth operators and freight forwarders, but the costs of using the Port's services are passed on to the exporters. Thus, exporters are ultimately the source of demand for the Port's services.

The degree of dependence of Victoria's export-oriented industries on the movement of goods across the wharves can be measured by their share of exports in total sales. A recent survey, conducted by the National Institute of Economic and Industry Research under the management of the Port of Melbourne Authority (based on a sample of representative Victorian firms already involved in exporting or are expected to become so shortly) revealed that 28% of them have at least 50% of their output exported; 16% have 20 to 49% of their output destined overseas and the majority (35%) have at least 5% of their output exported. On an industry basis, food and beverages is the most export-oriented sector in Victoria with at least 50% of the firms surveyed for this category reporting 50% of their output being sold overseas. Clothing and textiles are the most inward-looking sectors reflecting the national trends based on comparative advantage principles [Port of Melbourne Authority (1988)].

II. SIGNIFICANCE OF WHARFAGE COSTS

The Bureau of Transport Economics estimates (1988) on the direct charges (i.e. charges on port services, stevedoring and customs entries) for Australia's aggregate bulk and non-bulk exports can indicate the low significance of wharfage costs. Since wharfage is only one component of port services, it seems that its role in the transport chain of the export process is insignificant. However, although it may be the case on an aggregative basis, its effect on the profit calculus of individual firms could be significant, and since this is one of the few variables under the direct control of the PMA (apart from being the largest source of revenue), an examination of its role in the export process is justified.

The significance of the wharfage costs varies substantially across Victoria's export oriented industries. Overall, the proportion of transport costs (land and sea) in their total costs averages 11.3%, and sea freight costs accounted for, on average, 28.2% of total transport costs, based on the sample of Victorian firms surveyed. On an industry basis the Food and Beverages sector has the highest expenditure on freight as a proportion of their total cost (21%), followed by Basic Metals (12.5%). In contrast, the transport equipment sector has only 1% of its cost accounted for by freight.

Apart from the direct charges faced by Victorian exporters, there are also indirect charges associated with reliability and time. The major areas of concern which have imposed considerable costs on Victorian exporters are in the delays and costs involved in getting the goods out of the Port due to industrial disputes, truck queueing and poor work productivity levels. There are very little data available on the costs due to industrial disputes. Truck queueing adds about $60 or more to transport costs via demurrage. Untimely information on queue status and wrong use of time-slotting were the major causes of truck queueing. Several Victorian firms need to hold inventory levels because of the risk of delays or disruption. These higher inventory levels add about 1-2% to total costs for several firms.

Since there are no complete data available to make an accurate estimate of the indirect costs, the following section only considers the effect of a reduction in wharfage. However, the ensuing analysis can also be applied to the indirect costs.

III. TRADE AND WELFARE ANALYSIS OF REDUCED WHARFAGE COSTS

A. Theoretical Perspective

The trade and welfare implications of reduced wharfage charges on exports are determined largely by the extent of substitutability between Victorian exports and the importing country's domestic production, and the supply elasticity of Victorian exporters. The ensuing analysis is based on the following set of assumptions:

(a) The Victorian and international market are competitive;
(b) Any reduction in wharfage cost is effective;
(c) The export price (f.o.b.) reflects the real opportunity (social) cost;
(d) Other impediments to export are constant over the relevant period;
(e) Victorian export producers are subject to increasing costs;
(f) Wharfage charges are finally paid by the exporters;
(g) Exchange rates remain constant over the relevant period.

A reduction in wharfage costs may lead not only to an increase in trade flows, but also an increase in welfare for Victorian exporters associated with the terms of trade improvement, i.e. increases in their supply price. Figure 1 illustrates this point.

Before the wharfage charges are reduced, Victorian exporters supply OX_0 at the wharfage-included price,

$$p^1 = RPX_0(1+t+f)$$

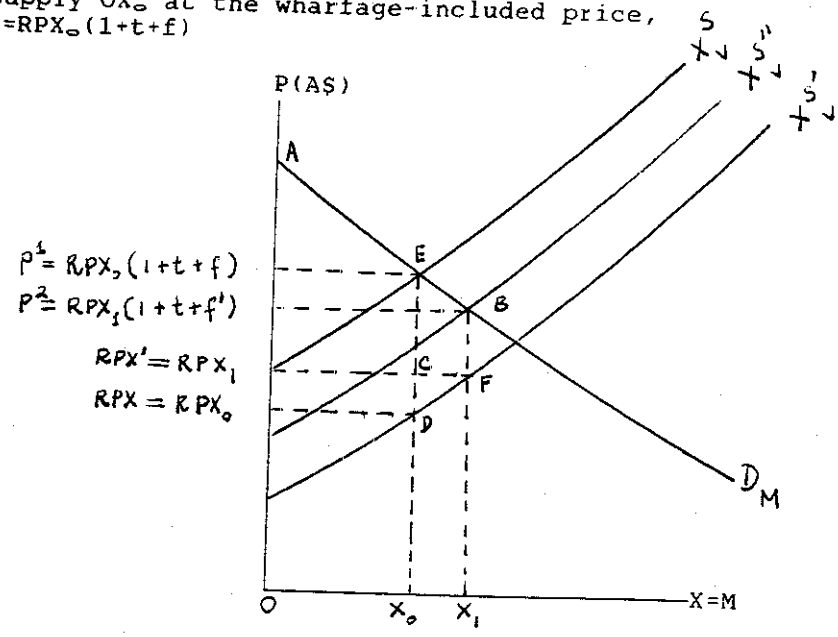

Figure 1. IMPORT MARKETS

After the wharfage costs are reduced, Victorian exports increase from OX_o to OX_1. This results from the lowering of the domestic price of Victorian exports in the importing country (p^2) which induces a substitution in consumption. This induced increase in consumption in the importing country depends on the magnitude of the initial wharfage and the elasticity of substitution between sources of exports. Increases in the price (f.o.b.) received by the Victorian exporters depends on the elasticity of export supply and the elasticity of substitution. On the assumption of an increasing cost function, part of the reduction in wharfage will be absorbed by the rising cost of production. Further, the closer substitutes similar products from various sources are, the more integrated the market becomes and thus, the more the Victorians are able to charge a price for their commodities close to the previous wharfage-inflated price (p^1).

International trade theory states that the extent of wharfage reduction that is absorbed by the Victorian exporters in terms of higher export prices (f.o.b.) depends on the relative elasticities of the Victorian export supply and the relevant importing country's import demand. The more responsive Victorian exporters relative to the relevant importers are with respect to changes in the price of Victorian exports, the lesser the proportion of wharfage reduction reflected in higher export prices (f.o.b.) and vice-versa.

The total gain for the Victorian exporters (change in producer's surplus)is equal to RPX_1 $FRPX_oD$. Part of the gain is in the form of a higher price for their original exports and the other in terms of an increase in production induced by higher returns.

As expected, the importing country has a share in the benefits from this: consumer's surplus increases by p^1p^2EB. To arrive at the PMA's net welfare gain from a fall in wharfage one must consider the foregone wharfage revenue which could have been collected on Victorian exports if the original wharfage rates had not been reduced.

B. Empirical Estimates

The preceding analysis has provided us a framework for quantifying the trade and welfare implications of a wharfage reduction. Specifically, to estimate the effect of reduced wharfage charges on the level of Victoria's exports requires calculation of the elasticity of demand with respect to wharfage costs.

The formula to calculate the elasticity of demand for an export good with respect to wharfage costs is derived from partial equilibrium principles. Its derivation is presented in Appendix 1.

The magnitude and distribution of benefits between exporters and importers is assessed using the concepts of producers' surplus and consumers' surplus on the assumption that part of a wharfage reduction will be reflected in higher export (f.o.b.) prices, the magnitude of which depends on the relative elasticities of the Victorian export supply and foreign demand. That any reduction in wharfage will not be fully reflected in the import price (c.i.f.) emanates from the fact that Victorian export producers are subject to increasing costs, and that there is an imperfect substitutability between the sources of import supply. The derivation of the formulas used to calculate the change in the supply price and the welfare effects associated with the change is explained in Appendix 2.

Price elasticity coefficients for Victoria's exports and three major export items (wool, petroleum products and vehicle parts) were estimated using quarterly time series data from 1978 (1) to 1987 (4). Due to data unavailability the price elasticity coefficients of foreign demand for Victoria's exports were derived from previous studies [i.e. Warner & Kreinin (1983)].

The specification of Victoria's export supply function is based on the derived demand principle where the volume of exports of a particular commodity through the Port is postulated to depend on the price of exports, Victoria's domestic output, capacity constraints and foreign income.

Table 1 presents the trade and welfare effects on the assumption that wharfage charges are reduced by 50%. Aggregate exports are further disaggregated into bulk and non-bulk categories to highlight the fact that wharfage charges for bulk commodities represent a significant proportion of cargo value. Column 6 of Table 1 presents the likely increases in annual exports if wharfage costs are reduced by 50%. It is evident that the trade response to reduced wharfage costs is quite small mainly due to the low elasticities of demand with respect to wharfage costs. The higher the proportion of the commodity price is spent on wharfage the higher is the value of wharfage elasticities. Thus, petroleum products which have the highest proportion spent on wharfages should experience the largest trade increase. Column 7 presents the percentage increases in the prices received by the Victorian exporters as a result of a wharfage reduction.

TABLE 1

TRADE AND WELFARE EFFECTS OF A WHARFAGE REDUCTION

	(1)	(2) E_m	(3) E_d	(4) f	(5) E_c	(6) ΔX	(7) ΔP^X	(8) ΔP^* (M$)	(9) ΔTR ($)	(10) ΔTL (M$)
1.	Aggregate									
	(a) Non-bulk	0.47	-0.57	0.0018	-0.0004	1099.7	0.61	4.95	1622	0.1
	(b) Bulk	0.37	-0.57	0.35	-0.099	50075.3	0.61	0.38	30046	0.61
2.	Disaggregate									
	(a) Wool	0.50	-0.80	0.0014	-0.0000	38.5	0.50	0.42	42	0.04
	(b) Petroleum	1.50	-1.5	0.038	-0.03	6093.0	0.50	0.12	3655	0.24
	(c) Vehicle Parts	2.13	-2.7	0.0027	-0.003	277.2	0.56	0.15	47	0.27

NOTATIONS

E_m : price elasticity of Victorian export supply;
E_d : price elasticity of demand for Victorian exports;
f : fraction of the commodity price spread on wharfage;
E_c : elasticity of demand w.r.t. wharfage costs;
ΔX : change in export volume (on the assumption that wharfage costs are reduced by 50%);
ΔP^X : change in the supply price of exports;
ΔP^* : change in exporters' profit/surplus
ΔTR : PMV's revenue gain
ΔTL : PMV's revenue loss.

NOTES:

(a) The following estimates are derived by applying the elasticity of demand with respect to the wharfage costs to the trade data for 1987/88: bulk 1,011,622 revenue tonnes; non-bulk 5,498,378 revenue tonnes; wool - 569,914 revenue tonnes; petroleum products - 406,201 revenue tonnes; vehicle parts - 104,770 revenue tonnes, on the assumption that wharfage costs are reduced by 50% from the original charges.

Sources:

Bureau of Transport Economics (1988), Economic Significance of the Waterfront. Chapter 5; Port of Melbourne Authority (1988). Victorian Trade and Transport Survey.

In most cases, the Victorian exporters will benefit more from the wharfage reduction in terms of increases for their terms of trade and consequently, their producers' surplus (or profit) (see Column 8). Columns 9 and 10 show the impact on the PMA's revenue. The increase in the PMA's revenue resulting from the induced trade increase amounted to only $31,668, in contrast to a revenue loss of $8.71 million due to the 50% reduction of the wharfage rates. It is, therefore, clear that there would be a net revenue loss of $8,678,332. In view of the static and partial nature of the above analysis, the derived figures can only be considered as indicative of the likely trade and welfare effects of a wharfage reduction. Further investigation into other major export commodities is, therefore, required before a more accurate assessment of the likely benefits and costs associated with a wharfage reduction can be made.

CONCLUSION

The objective of this paper is to quantify any trade and welfare effects of a wharfage reduction. The use of estimated relative demand and supply elasticities suggested that no significant increase in trade and revenue is likely to occur as a result of this policy option due to the relatively low elasticities with respect to wharfage costs. Further, at least a half of any wharfage reduction will be passed on to the Victorian exporters in terms of higher export prices. The division of welfare gains between Victorian exporters and overseas importers is in favour of Victorian exporters as further evidenced by the estimation of changes in producers' surplus and consumers' surplus. However, from the viewpoint of the PMA, any wharfage reduction will result in a trade and revenue loss.

The finding also has a policy implication for the PMA's proposed pricing policy. The new pricing structure which is due for implementation in July 1990 advocates lower wharfage rates and higher rates for vessel and berth charges. The basic aim behind this move has been that the new charging structure in real terms will be revenue neutral. Revenue neutrality was considered as having been achieved when the total revenue generated by the new set of charge rates applied to 1987/88 shipping and cargo operations was equal to the total revenue generated by applying the current charge rates to the same trade and shipping operations. The above finding can throw some light on the question of revenue neutrality. [New Pricing Structure (1989, pp3-5)].

WHARFAGE COSTS

It is possible that shipping charges such as tonnage dues, berth rentals and area hire (directly paid by the shipping companies/agents) constitute a significant proportion of a shipping company/agent's operation so that the likely response of that shipowner/agent to the proposed increased charges in terms of frequency of visits at the Port of Melbourne will be significant. Hence, variations in the elasticities with respect to the changes in charges will make it difficult to ascertain the net trade and revenue impact of such a change in the pricing policy. This study is the first step in the right direction by assessing the trade elasticities on an industry/commodity basis. Further, in the context of the Victorian Government's policy of promoting Victoria's exports, the study supports a case for a more discriminatory approach whereby wharfage rates can be varied depending on the trade elasticities of the various commodities.

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APPENDIX 1

To estimate the effect of reduced wharfage charges on the level of exports requires calculation of the elasticity of demand with respect to wharfage costs. In this case the formula adopted by the Bureau of Transport Economics (1988) is useful:-

$$E_t = \frac{f\,E_s E_d}{E_s-(1-f)E_d} \quad \text{where} \qquad (1)$$

E_t = Elasticity of demand for transport;

E_s = Elasticity of supply of the commodity in the exporting country;

E_d = Elasticity of demand for the commodity in the importing country;

f = Fraction of final commodity price spent on transport.

An equivalent formula can be used to calculate the price elasticity of demand for PMA services. Because the demand for PMA services is a derived demand the elasticity provided by the formula is also the elasticity of demand for the trade good with respect to wharfage costs;

$$E_w = \frac{f\,E_s\,E_d}{E_s-(1-f)E_d} \quad \text{where} \qquad (2)$$

E_w = elasticity of demand for the traded good with respect to wharfage costs;

f = fraction of final commodity price spent on wharfage.

E_s = elasticity of supply of the commodity in question.

E_d = elasticity of demand for the commodity in the importing country.

APPENDIX 2
(Based on Figure 1)

Welfare Consequence for Victorian Exporters

The division of a wharfage reduction between importers and exporters depends on the relative elasticities of import demand and export supply. Relative elasticities are influenced by the type of commodity involved, characteristic of the market and the share of Victorian exports in importing country's domestic consumption and other factors as discussed in Kreinin (1961). Thus, the proportion of a wharfage reduction reflected in the increase in the Victorian supply price (f.o.b.) is given by:

$$RPX=1/(1+E_s/E_d) \quad \text{where} \tag{3}$$

RPX=supply(f.o.b.) price received by the Victorian exporters;

E_s=price elasticity of Victorian export supply;

E_d=Price elasticity of demand for Victorian exports.

Thus, given the Victorian export supply function,

$$X^s=X^s[RPX,FD,O,PoM/PoA,PoM/PoS,e)$$

where $\check{e}$ denotes stochastic disturbances, a change in Victorian producers' surplus is:

$$\Delta P^s=\int_{L}^{\check{}} X^s=(RPX,FD,O,\ldots)dRPX \tag{4}$$

Thus, if the export supply function is linear, the surplus change associated with increases in export prices, ceteris paribus, is:

$$\Delta P^s=\alpha_0(RPX'-RPX)+\alpha_1 \frac{\{RPX'^2-RPX^2\}}{\{2\}} \tag{5}$$

However, if the Victorian export function is log-linear,

$$\Delta P^s=\frac{A}{\alpha_1+1}\{RPX'^{\alpha_1+1}-RPX^{\alpha_1+1}\}\bar{FD}\ldots \tag{6}$$

Welfare Consequence for Importers

It is assumed that the other part of the wharfage reduction is reflected in lower import prices. Changes in importers' welfare as a result of greater trade opportunities at lower prices can, therefore, be measured using the concept of consumers' surplus. The change in consumers' surplus, the area under the import demand curve (Figure 1) and above the import price, resulting from the reduction in the importers' price and subsequent increase in imports is given by:

$$\Delta C^{m} = \xi_{o}(p^{2}-p^{1}) - \xi_{1}\left[\frac{p^{2}-p^{1}}{2}\right]^{2} \quad \text{for a linear case}$$

$$\Delta C^{m} = \frac{A}{-\xi_{1}+1}\left\{p^{2\,-\xi_{1}+1} - p^{1\,-\xi_{1}+1}\right\}$$

for a log linear case (8)

Similarly, the proportion of the reduction reflected in a decrease in the import price is measured by:

$$p^{2}-p^{1} = 1/[(1+E_{d}/E_{m})] \qquad (9)$$

Welfare consequences for the PMA

There will be a revenue loss associated with the amount of revenue which could have been collected on exports had there been no reduction. The amount of revenue loss may be estimated by:

$$\Delta TL = f^{o}(X_{o}) - f^{1}(X_{o}) \quad \text{where} \qquad (9)$$

$$\Delta TL = X_{o}(f^{o}-f^{1})$$

f^{o} = initial wharfage rates

f^{1} = reduced wharfage rates

X_{o} = volume of exports before the reduction of wharfage rates.

However, any additional increase in exports stimulated by the reduced wharfage will also generate additional revenues for the PMA equal to:

$$\Delta TR = \Delta X(f^{1})$$