EFFICIENT REGULATION
THEORY AND PRACTICE IN AUSTRALIA

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ABSTRACT

The aim of this paper is four-fold. First, it reviews the key concepts of market failure, efficient regulation, and regulatory failure. Second, it surveys the current regulatory networks impinging on freight transport by road and rail in Australia. Third, it develops a simple model to explain welfare losses due to regulatory and other encumbrances in the freight transport markets. Fourth, this model is used to determine which regulations in Australia are worth keeping and which should be dismantled.

In this simplified model we assume that the railway industry is a rent-seeking monopoly. Under this scenario, monopoly rents accruing to railway systems and their employees are real social costs. These costs may be an expression of technical inefficiency exemplified by say over-employment of certain factors of production. The measurement of these social welfare losses boils down to calculating areas of well defined trapeziums. This is done for each of those regulated freight tasks for which data can be obtained in Australia.

Conclusions are made as to which regulations need dismantling and which need maintaining. The results are based on rough estimates because of limited availability of the relevant information.

INTRODUCTION

A useful starting point to describing efficient regulation theory and practice is to clearly define the three concepts of market failure regulatory failure and efficient regulation.

Market failure

It is well known that the welfare of society as a whole will not be maximised through the operation of completely market dictated processes within a modern transport industry. Under perfect competition there are numerous identical producers in a market each producing an homogeneous product. That product is sold at a price which can not be affected by an individual producer, and there are no barriers to the entry or exit of producers.

The reality of the road and rail freight transport industry in Australia is very different. It is characterised by:

- Product differentiation and market concentration
  There are only six government-owned railways in Australia and, even though road hauliers are more numerous, the degree of market concentration in the road haulage industry reflects a marked deviation from the perfectly competitive model. For example, in 1982-83, the largest four road operators controlled 35 per cent of interstate road traffic (see May et al 1984, 36).

- Barriers to entry and exit
  While Australian government railways are prevented from curtailing certain unprofitable activities, potential road operators are barred from entering some sub markets by explicit prohibition by government (see May et al 1984).

- Negative externalities
  The social costs associated with the use of the road space by motorists include congestion, noise, emissions, accidents and the excessive rate of depletion of scarce fuel. Thus, the usage of the road space without a way of penalising the road user (for example by way of an appropriate extra tax) for the inconvenience he/she causes to the rest of the community results in relative prices that bias choice in favour of road usage, leads to low volumes of freight transported by the railway system, and leads to deficits consuming a disproportionate share of tax revenue.

These conditions are all examples of market failure. When they are present separately or concurrently in an industry or market, there is no guarantee that social welfare will be maximised by leaving the market to solve the problems of:

- what to produce (for example, road transport alone, rail transport alone, integrated road and rail transport);
- how to produce it (choice of appropriate cost minimising technology);
- how to distribute the product(s) among individuals or social groupings; and
- how to devise efficient charging structures for road use.

The outcome might well be an inappropriate mix of transport services with inefficient technologies and distributed in ways that are far from equitable.

Regulatory failure

In some situations of market failure the introduction and implementation of certain regulatory schemes can lead to situations worse than would have existed if market solutions prevailed. These are the circumstances of regulatory failure. The regulations introduced will be welfare-inefficient in the sense that a better regime could be created by dismantling the regulatory network.

Regulatory failure is a result of the introduction of bad or inappropriate regulations. The current international mood of deregulation results from the belief that existing forms of regulation have led to situations that are worse than would have prevailed in the absence of regulation.

However an instance of regulatory failure does not imply that market failure no longer exists and does not justify complete deregulation. In the US it is now acknowledged that:

> '...regulation has not imposed as large a social cost as initially claimed. On the other hand, there is also agreement that the cost has not been trivial (i.e. in the order of one billion dollars per annum). Unfortunately, *it is not clear that deregulation will eliminate this welfare loss* (Winston 1985, 83).

The response to bad regulation introduced to correct market failure is not complete deregulation. A possible alternative is the substitution of more efficient regulation.

The available evidence in Australia suggests that the last fifty eight years of Australian railway and road intrastate regulation provide an example of regulatory failure. Regulations which were established to improve the commercial viability of the railways have co-existed with ever worsening financial affairs of railways.

Efficient regulation

When Adam Smith's 'invisible hand' is no longer reliable in the determination of what to produce, how to produce and how to distribute a product, then a mechanism is needed to modify the market solution to ensure optimality in product choice, efficiency in production and equity in the distribution of products and services.

Taplin (1982) while not using the term 'efficient regulation' raised the major issues underlying this concept when be said that

> The problems of transport have resulted mainly from the sins of government in doing those things which they ought not to have done and, to a lesser extent, in not doing those things which they ought to have done. Large sectors of transport, if unimpeded by government, would tend to stable and socially beneficial competition, but it is in these sectors, such as trucking, airlines and taxis, that

> government intervention has been greatest and most damaging. Conversely, they have failed to act where they could do some good, for example, by charging rush-hour motorists for the costs they impose on others.....
>
> ...The occurrence of natural monopoly is seen as the proper basis for economic regulation, the appropriate test being to observe whether an unregulated industry falls into the hands of one or a few firms with a substantial degree of monopoly power. In the past, the railway has been the outstanding case, but its power is now constrained by road competition. Some regulation is still appropriate, probably by an independent body such as the Interstate Commission, but it must be noted that railways problems result primarily from inept intrusions by governments. The future of the railways systems can only be secured by business like management pursuing normal commercial goals (Taplin 1982, p.1-2)).

There are many ways of intervening in and regulating an industry, like the Australian road and rail freight transport industry, which is affected by some form of market failure. The optimal solution is never more than a second best solution.

The search for efficient regulation can be, and is, a frustrating exercise. An analyst in the Interstate Commerce Commission in the USA working to identify ways of nudging US railroads towards an efficient solution of their regulatory problems has described this frustration in the following terms:

> ...Ramsey pricing is essentially a public finance tool or a pricing technique for a nationalised industry. As such it is not a suitable response to deregulation. The attention given by the Commission to Ramsey pricing shows that they do not regard first-best marginal cost pricing as a viable alternative. The second best is illegal because it requires revenue pooling. The third best is occupied by Braeutigam's (1979) "totally regulated second best". Therefore deregulation must be fourth-best or worse. Perhaps fourth best is the normal state of the transport industry. Deregulation should then be advocated on its own merits and not for disappointing efficiency reasons (Damus 1984, 60).

There is of course a non-uniqueness problem that is if an efficient regulation is defined as one which improves, in terms of social welfare, on the unregulated market solution, then there are many such regulatory regimes. Clearly, the best of all such regimes is, to be preferred.

The literature on the efficiency of regulation is very cautious and, while it does not support 'laissez faire' policies, neither does it argue for indiscriminate regulation in all areas of transport. The impression created in this literature is that before the status quo is changed there must be sufficient information about the mode which is the target of change. There must also be similar information on the behaviour of competing transport modes to demonstrate that a market solution is worse than one based on the existing regulation, which in turn is worse than that based on the proposed new regulation. Furthermore this information is also needed to show whether any

proposed regulation is better than all other feasible regulations in terms of benefits in the social welfare it produces.

Regulatory regimes

There is a whole range of possible regulatory regimes from which a regulator can choose. Five of these regimes are briefly described here.

Unregulated contestable
The base case is referred to as an unregulated contestable situation. The performance of motor carriers in the last fifty years in an industry which was once dominated by rail suggests that the freight transport industry is potentially contestable. The virtue of contestability is that it eliminates monopoly power as a form of market failure which automatically requires regulation.

A contestable market will have all or most of the desirable welfare consequences associated with perfectly competitive markets. First, in such markets there are no super-normal profits in the long run, since any such profits will attract entrants who will contest for a share in that profit. Second, production inefficiencies will be absent in the long run since unncessary costs will attract into the industry lower cost producers who will earn supernormal profits. Third, in the long run, no product or service produced in a contestable market can be sold at a price less than its marginal cost, thus eliminating the inefficiency associated with cross-subsidisation. There is one cautionary note though, namely that a contestable market offers some presumption, but not guarantee, that inefficiencies will be minimised (see Starkie and Starrs 1984).

Cross-subsidisation
In the second regulatory regime one uses various forms of cross-subsidies. For example, high value manufactured goods might be charged a higher rate per tonne kilometre in order that rural agricultural products may be charged a lower rate. Similarly profitable bulk commodities may be used to cross-subsidise the less profitable less than car load traffics. This regulatory regime, in a theoretical context, is less welfare efficient than a direct subsidy; Gwilliam (1987, 8). Generally though one would need information on demand elasticities and the demand functions relevant to the subsidised and subsidising market segments before a proper appraisal can be done.

Direct subsidies
With respect to direct subsidies, the third regulatory regime, there is a general fear that, compared to no subsidy situations, transport subsidy creates a need for increased tax yields; these taxes have adverse spin-off effects either on resource allocation or on output; thus there is some widely diffused, probably unmeasurable general detriment associated with these subsidies (Gwilliam 1987, 15).

Boiteux pricing
Under the fourth regulatory regime the regulator could insist on some minimum acceptable performance level and impose this on the transport firm in question as a constraint. This constraint could be a requirement to break even or to recover a certain proportion of the costs of the provision of transport or achieve a certain deficit

level. One cautionary note with respect to this regulatory regime is that if the revenue requirement is non-negative then it requires that prices for the services of the relevant transport firm generally exceed marginal costs or else the revenue requirements might not be met.

Funding denial and other regulatory regimes

The last regulatory regime to be discussed is one which introduces funding penalties to encourage efficiency. A government funded transport firm is encouraged to increase efficiency and thus lower average costs by the threat that if the efficiency and cost reduction measures are not implemented then funding for expansion or for recurrent expenditure in the future would be denied. Funding denial is a compromise between regimes of coercion and ones inducing voluntary compliance. Like coercion the State would declare its intentions, say, relating to increased efficiency and the policy result (that is, to fund or not to fund) depends on the corrective decision made by the railway system (see King 1987).

In terms of efficiency, the results from the literature review on the economics of regulation are disappointing in that there is no clear theoretical indication of the likely impact of regulation on average costs. This is the nature of interventionist policies in the presence of market failure. The problem is that:

> ...if we assume that the net revenue allowed these enterprises is less than the amount profit maximisation would yield, some degree of freedom is introduced into the pricing of the commodities. Of course some amount of freedom is also introduced into the choice of method of production. We assume throughout that *good will, pride of service, patriotism* or the *shrewdness of regulators* assure that whatever output combination is chosen is produced at minimum cost (Baumol and Bradford 1970, 266).

In other words, once we depart from the discipline of Adam Smith's 'invisible hand' there is the serious danger of using sub-optimal methods of production no matter what regulatory regime is adopted.

To establish a regime of efficient regulation, it is essential to ensure that the intention to achieve reduced deficits and increased efficiency is not sabotaged by inappropriately massaged pricing rules. This is so important when subsidies are provided for the supply of community service obligations, that it might require that an independent process of cost monitoring is established. Nevertheless, the results of Albon and Kirby (1983) should be noted. They conclude that:

> ... the regulated firm has an incentive to capture ... potential rents through inflating or padding costs of production with unnecessary expenses. ... However increased attention to cost control may not be an appropriate solution to the inefficiences of the regulated monopoly. The surveillance of cost levels is a costly exercise in itself so that additional regulatory costs must be incurred in our effort to reduce the waste.

Given this background regulations covering road and rail freight transport in Australia, are examined to determine the extent to which they are efficient. Before this is done it is emphasised that the search for efficient regulation is a two way process. On the one hand one examines the current regulations to assess their efficiency. On the other hand one examines the areas of economic activity currently unregulated to determine whether the introdution of regulation would lead to a better solution.

Areas currently unregulated needing regulation

To date only three areas which are currently unregulated but which might be improved by regulation have been identified. The first is related to bulk liquids which are either inflammable or which are highly toxic. These are currently regulated to rail only in some states (see Table 1). Extending the regulations to other States would be desirable because it would lower the probability of the occurence of accidents involving road haulage trucks carrying these commodities. The benefits from the health and potential environmental disasters avoided in the process are likely to outweigh the increase in freight charges resulting from the modal switch.

The second area which might require regulation is the owner-driver segment of the road haulage industry. The regulation should be one which is aimed at increasing the quality of new entrants in the industry. For example, it might introduce minimum age, driving experience, small business management skills and similar qualitative controls which will improve not only the safety/accident risks in the industry, but also the long-term financial viability of the enterprises of both existing and new road hauliers.

The third area which is also probably the most important is the urban passenger transport market. It is important partly because it is one of the major contributors to the deficits incurred by Australian State owned railways and partly because it is permeated by numerous regulations many of which have impacts of currently unknown directions and magnitudes and partly because it is an area where the cases for categorical equity and community service obligations are strongest. This submarket is not discussed in this Paper but is currently the subject of substantial research effort.

ROAD AND RAIL REGULATIONS IN AUSTRALIA: FREIGHT

Table 1 summarises, the key regulatory aspects of the Australian road and rail transport industries for 10 commodity traffics.

Effectively, what has been created by government legislation in the bulk grain transport market, for example, is an artifical railway monopoly. Without these artificial barriers to entry, the bulk grain market is contestable and it is believed that

> ... in many areas road/rail competition will enable the potential resource cost savings ... to be substantially realised ... where rail is inferior, competitive pressures within the road haulage industry and ease of entry will ensure that competitive behaviour prevails (Royal Commission into Grain Storage, Handling and Transport 1987a, 64).

TABLE 1 ROAD AND RAIL REGULATIONS IN AUSTRALIA: FREIGHT

Commodity	*Vic*	*NSW*	*Qld*	*WA*	*SA (AN)*	*Tas (AN)*
Bulk grain	D,R?	D,S, O(exp)	R,D	R,D	O,D	
Bulk coal and briquettes	R	O	R			O
Bulk sand and quarry products	R		R			O
Bulk ores			R			
Bulk liquids (heavy)	R			R		
Bulk cement	R			R		O
Fertilisers	R?			R		
Woodchips	R			R		
Motor vehicles			R			
Chemicals, dangerous goods			R			O

Notes R?: Regulated but there are moves to deregulate.
R : Regulated or restricted to rail.
O : Other instrument used with the default result of restricting traffic to rail.
S : Subsidy.
D : Price discrimination.
AN: Australian National.
(exp): Export; ie Bulk grain for export.

In the table, R stands for a situation where the commodity in question is restricted to rail by legislation. R? for Victoria indicates uncertainty as to the current regulatory regime. This uncertainty is a result of the recent Victorian Supreme Court ruling that the nineteenth century determination which prevented road haulage operators from transporting wheat in competition with V-Line, was invalid.

The 'O' for New South Wales and South Australia means that, while there is no act of parliament restricting bulk grain to the relevant railway systems, there are, nevertheless, other measures which have approximately the same result. In New South Wales, export wheat is effectively reserved to rail as there are no road receival facilities for grain. In South Australia, the imposition of a surcharge ($2.50 per tonne in 1986-87) on grain stored in railway silos but moved to rail-served ports by road, has the effect of restraining the road transport industry.

Some aspects of discriminatory pricing arrangements (entry D in Table 1) are given in the report of the Royal Commission into Grain Storage, Handling and Transport (1987b):

> in Victoria, the current process of setting freight rates involves annual consultation between the Grains Group, the Australian Wheat Board, the Australian Barley Board, the Grain Elevators Board of Victoria and V/Line;
>
> in Queensland, Queensland Railways obtains the power to exclusively transport non-statutory grains which are handled or marketed by signatories to the Rail Freight Agreement. These signatories include Bulk Grains Queensland, the various statutory marketing boards and Elders-Queensland Graingrowers Association;
>
> in Western Australia; the railway freight rates are determined under the terms of the Grain Agreement which involves Westrail, Cooperative Bulk Handling of Western Australia, the Australian Wheat Board, the Grain Pool of Western Australia, the Pastoralists and Graziers Association of Western Australia and the Western Australian Farmers Federation.

The Royal Commission concluded that:

> ...Overall, the nature of pricing formulae used by each authority means that the cost to an individual grower does not necessarily reflect the cost (in some cases not even the avoidable cost) of the service which is provided (ibid, 18).

These distortions have significant implications for resource allocation, investment decisions and equity considerations when subsidies are introduced (as is the case in New South Wales).

The evidence seems to suggest that in some of these markets the best thing to do is to deregulate completely. There will, however, be road damage as a result of increased road usage.

Recent analysis demonstrates that:

> ... If roads are repaired when they reach a predetermined critical condition (not necessarily optimally set) and if road damage is fully attributable to traffic, then, in a steady state with zero traffic growth, the average road damage externality is zero and the average marginal social cost of road use is equal to the average road maintenance costs (Newberry 1988).

Given this result, the issue becomes one of whether there is enough political will to enforce a system where the road hauliers pay a user charge based on the road surface damaging power of their vehicles.

THE EFFICIENCY OF CURRENT REGULATION

As a forerunner to establishing efficiency the welfare implications of existing regulations are examined using a simple model of the land based freight transport industry.

A simple model

Assume that the modal split is such that road carries 0 per cent and rail carries 100 per cent (approximately) of the regulated traffic. Figure 1 represents this situation.

The initial position is at point A where by law, rail has a monopoly in the transportation of regulated traffics.

Given A, the ensuing analysis requires:

- Determining the freight rates of road and rail. Those for rail are estimatable. Those for road are not easy to ascertain because in a market where movement by road is prohibited there are no relevant observations.

- Determining the modal split after deregulation.

- Assessing the road damage costs, congestion, and similar negative externalities associated with increased road usage after deregulation.

In Figure 1, various types of situations can arise.

For example, the relative freight rates after deregulation might be represented by the slope of the line AC in which case road haulage might turn out to be so inefficient that the 100 per cent market share for rail is preserved. This is unlikely. Equally unlikely and unacceptable is the other extreme not depicted on Figure 1 where deregulation leads to zero per cent market share to rail and a hundred per cent market share to road. The likely result would be similar to one represented by M* in Figure 1 with some reduction in the railways' market share and a substantial increase in the road hauliers' market share. The final or equilibrium modal split depends on a number of factors including cross price elasticies, the value of the product, the average length of haul, the quality of service differentials between the modes, and the importance of service attributes like reliability and speed of delivery to the shipper of the commodity in question.

The regulatory regime converts railway systems into monopolies facing downward sloping demand curve (like AD in Figure 2) for their services, with a corresponding downward marginal revenue curve, like AE in Figure 2. By simplifying and assuming that the industry operates under constant returns to scale, the average and marginal cost curves are horizontal as in Figure 2.

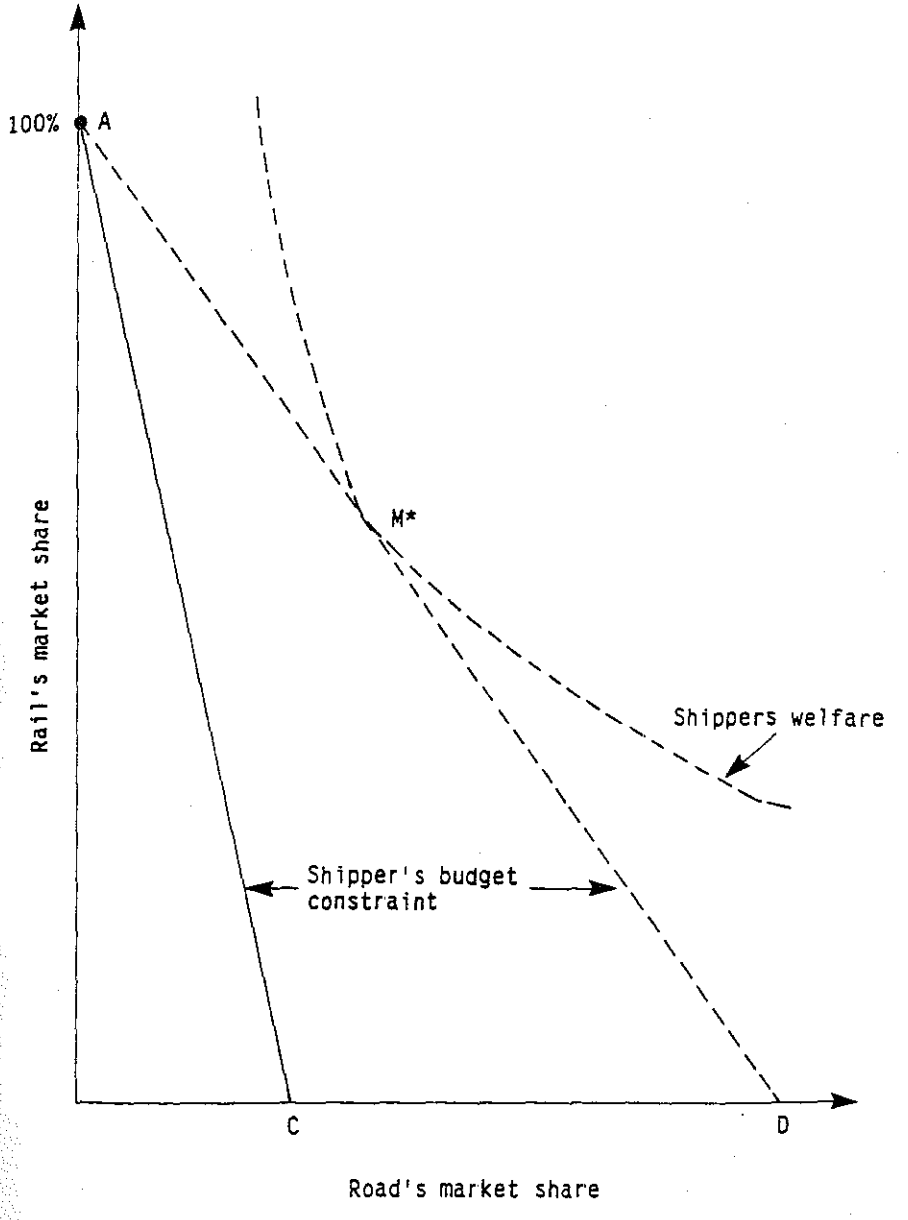

Figure 1 Modal split with and without regulation

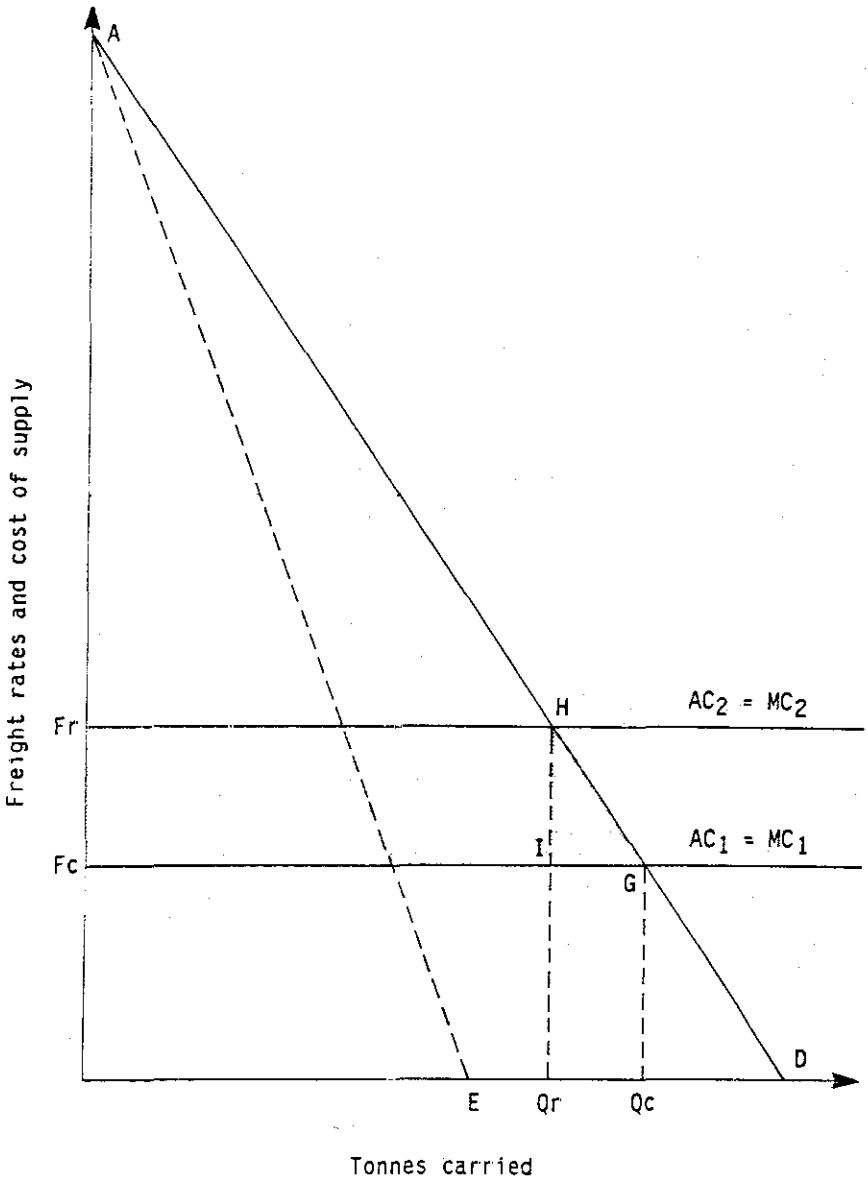

Figure 2 The welfare cost of freight traffic regulation

Fc is not observable in a regulated environment. It is estimated by the freight rate which the road operator would have charged had the market been open to road hauliers. This estimate is then modified in order to accomodate the various negative externalities associated with increased road usage.

The solution under regulation is given by (Fr, Qr) where Fr is the rail freight rate under regulation. Similarly Qr is the tonnage of the regulated commodity carried by rail.

The major assumption in the analysis is one that Posner (1975) introduced into the literature. It can be stated as follows using Figure 2. Complete monopolisation of an industry leads to welfare losses equal to F_2GHF_2 in Figure 2. This area is the sum of what is normally labeled the welfare loss HIG plus the area of IF_2F_1H. Traditionally IF_2F_1H has been viewed as representing a redistribution of income from consumers to producers and no welfare loss has been associated with this transfer. Posner disagreed with this characterisation of IF_2F_1H. He argued that the level of excess profits due to monopoly also represents the amount of resources that competing potential suppliers would be willing to expend in order to obtain the monopoly position. The railway systems examined here do not all make profits. Thus for some railway systems in the Australian case IF_2F_1H does comprise financial losses. The losses made are under-written by the Australian society and are paid for from taxpayers money. They are avoidable. They are representations of the technical inefficiency associated with railway monopolisation and enabled by legislation, and they represent the expenditure of scarce resources without the production of any social benefits.

This is a form of technical inefficiency which shifts the average cost curve upwards as a result of (for example)

- over-employment of certain input factors (eg labour) beyond what is technically optimal given the volume of traffic; and
- paying certain input factors rewards over and above what they are worth given market conditions.

Either of the above mentioned has a measurable welfare cost which is composed of (see Figure 2).

- captured rents
- deadweight consumer surplus loss.

Captured rents are given by the rectangle FcIHFr in the figure. They are captured by the railway employees in the sense that had the market not been regulated or had the railway systems (even under regulation) achieved the contestable freight rates Fc, the rectangle FcIHFr would have been part of consumer surplus. It is now part of the rewards/returns to the factor inputs used in the railway systems.

Deadweight consumer surplus loss is given by the triangle HIG in the figure. This is deadweight loss in the sense that under contestability conditions the area HIG would be part of consumer surplus, but in the presence of regulation it is lost to both the users of rail and the suppliers of rail transport services.

The benchmark rates

What is measured are the welfare costs due to technical inefficiency associated with the regulated environment. The question of a benchmark rate is controversial because there are so many possible freight rates which one could use. For example, the Industries Assistance Commission (1988) mentions the following five possible rates:

- the efficient price rate, which is the rail freight rate which would have prevailed if rail infrastructure was priced efficiently;
- the road freight rate; that is the rate which road would have charged had road haulage been used to perform the task regulated to rail;
- the private rail rate, the rate which a privately owned, profit maximising rail system would have charged;
- the overseas rail charge, this being the charge which prevails overseas for railway systems performing similar tasks under topographical features similar to the ones in Australia; and
- the competitive cost rate which is the rate that would prevail if rail operated under competitive conditions.

The commercial road freight rate

The road freight rates are used as the benchmark rates because of the availability of reasonable recent studies which have examined these rates. For example, the Industries Assistance Commission (1988) used a road freight benchmark in their study of excess rail charges in the transportation of export coal in New South Wales.

How the actual figures were arrived at is detailed in the discussion following Tables 2 - 4.

It is asssumed throughout that the commercial road and rail freight rates do take into account the backhaul problem. That is, the per tonne road and rail rates are based on a round return trip and are determined in such a way that the possible traffic imbalances on the trip are accounted for properly.

The commercial road freight rate used in the first round of computations overstates the efficiency of road haulage as compared to rail because it ignores

- the increased road pavement damage costs associated with the modal switch by users from rail to road
- the costs of widening roads, providing passing lanes, lower gradients and bridge strengthening
- the congestion costs
- the costs of road accidents involving trucks and
- the pollution and other environmental costs.

The corrected road rate

The correct road rate is a modification of the commercial road rate in order to accomodate the negative externalities listed above which are associated with increased road usage.

The road rate, f, per tonne-kilometre depends on the traffic tonnage (T) carried by road hauliers and the distance, D, over where this traffic is hauled together with the quality, S, of the existing road surface.

Thus one can write this rate as

$$f(T,D) = \begin{cases} 0 \text{ if } T = 0,\ D = 0 \\ a(T,D) + b(S,T,D) \text{ if } T,\ D > 0 \\ b(S,D) \text{ if } T = 0 \end{cases}$$

Where a(T,D) is the commercial road frieght rate and b(S,T,D) is to modify the commercial rate for the negative externalities associated with road usage. Note that the negative externalities factor is not zero when an empty truck uses some road space.

Obviously this corrected road rate would vary from State to State and across commodities. The construction, even if synthetically, of these corrected rates for the States and the commodities discussed here would be a mammoth task. Since the results are meant to be indicative and what is required is an explicit recognition of the negative externaltities associated with increased use of road haulage, a simpler approach was used. This simpler approach relies on Tiborc, Rees-Mogg and Jackson (1987) who state that:

> The results of road damage evaluation based on the transer of 25 per cent, 50 per cent and 100 per cent of rail grain traffic to the road system demonstrates the variable impact of traffic transfer assumptions on the unit cost of road damage:
>
> - 50.4 cents per vehicle kilometre, at 25 per cent transfer
> - 38.2 cents per vehicle kilometre, at 50 per cent transfer
> - 27.6 cents per vehicle kilometre, at 100 per cent transfer.
>
> These results indicate that the unit costs associated with increasing traffic on the road system decrease at a decreasing rate, as the volume of the added traffic increases. As smaller and smaller increments are considered, the unit cost can be expected to increase substantially.
>
> With the foregoing in mind, it is proposed that the unit damage results associated with the 100 per cent grain transfer evaluation should be adopted for general regulatory assessment.

> The virtues of this approach are that it assumes a significant transfer of traffic to road, spread over a large portion of the rail competitive road network, and reflects the averaging approach which needs to be applied in the first instance at least.
>
> This approach necessarily constitutes a compromise and further work may well result in some adjustments over time. However, even given additional information and analysis, the same broad approach will need to be adopted as the information needs, administrative costs and practical difficulties inherent in a highly refined approach would be prohibitive (p 24).'

The commercial rates needed to be increased by 0.815 cents per net tonne kilometre to account for the above mentioned road damage costs. Adopting their effective maximum distance of 350 kilometres for road haulage (of petroleum products) then the commercial road rates in this Paper need to be increased by 0.815 x 350 cents per tonne, that is by $2.85 per tonne.

Thus, the corrected road rates are given by the commerical road freight rate plus a $2.85 surcharge per tonne to cover negative externalities associated with road haulage. It must be emphasised that this figure is only indicative. The surcharge necessary to fully account for these externalities may be higher or lower than this figure depending on the quality of the existing road surface, the type of truck that is used in road haulage, the commodity in question, the existing traffic flows in the road network and a multitude of other factors.

Determining which regulations to dismantle

Under a deregulated environment the division of traffics between the modes (road versus rail) is a product of price and service quality of each mode as opposed to being prescribed by legislation. Initially it is assumed that all that happens after deregulation is that optimal modal shifts across various traffics is achieved by rail concentrating on those traffics where it has a comparative advantage and likewise for road.

With a constant number of trucks on Australian roads, the extent of road damage costs would on balance not differ from the current levels. If this assumption is true then one can use the current commercial road freight rates as the benchmark rates. If it is not true then the corrected road rates are the appropriate bench mark rates.

In Tables 2-4, results are reported for two benchmark rates:

- the road freight rate (as discussed above); and
- the corrected road rate.

In deciding which regulations to dismantle and which to leave, Posner's measure of welfare loss is used as a reasonable indicator of the negative impacts of regulation.

The formula used to compute the welfare loss due to regulation was developed by Posner (1975) under the assumption of a linear demand curve. By this formula the social welfare loss denoted by L is

$$L = Rr\,(1-k) + 0.5\,Rr\,(1-k)\,e\,(1-k)$$
$$= \text{captured rents} + \text{deadweight consumer surplus loss}$$

where

Rr = Fr Qr = revenue under regulation
k = Fb/Fr; Fb is a bench mark freight rate and Fr is as defined earlier
e = absolute value of the price elasticity at (Fr, Qr)

Welfare losses are categorised as significant if they form at least 1 per cent or more of the freight deficit for V/Line in Victoria where freight deficit data are available. For other systems (that is, Queensland Railways, State Rail Authority and Westrail) where freight deficit figures are not available, an arbitrary figure of $10 million dollars was used as a threshold value below which welfare losses were deemed to be insignificant and above which they were deemed to be significant.

Dismantling of the regulation relating to the particular regulated traffic is recommended if the welfare loss is significant. For such traffics, dismantling the regulatory network impinging on their efficient transportation will force road and rail to concentrate on those activities for which each mode has the comparative advantage. This might provide the discipline to force the railway systems to search for those least cost methods of supplying railway transport services. The results are presented by State.

Victoria

In Table 2, the data on railway revenue was obtained from State Transport Authority, Victoria (1987, 53). The figures relate to the 1986-87 financial year. Note that bulk grain in Table 2 corresponds to export/local grain in the source document. Similarly coal and briquettes, bulk sands and etc, bulk liquids, woodchips, in Table 2 correspond to solid fuels, quarry products, petroleum and timber respectively in the source document. Data on tonnes carried was extracted from State Transport Authority, Victoria (1987, Table 5). The rail freight rate was estimated by the quotient of freight revenue and tonnes carried for the relevant commodity. The price elasticity of demand in Table 2 is the own price elasticity of demand for rail services and the relevant figures are obtained from Hooper (1988). As indicated earlier two benchmark rates are used. In Table 2 the first benchmark, that is the road freight rate which would have prevailed if road hauliers were free to contest the currently protected freight, is arrived at as follows:

- current rail rates on average are assumed to comprise what road hauliers would have charged plus an excess charge of 27 1/2 per cent over and above the road hauliers' rate;

- the above figure on excess charges is derived from Industries Assistance Commission (1988, 141); and

this figure is only indicative of what the road rate would have been. It is impossible to determine the exact rate since the legislative and other institutional arrangements are such that there are no observations on road costs or revenue for the relevant traffics.

The corrected road rate is simply the commercial road freight plus $2.85 to cover the negative externalities associated with road haulage.

In Table 2, k(a) is the ratio of the road freight rate to the rail freight rate while k(b) is the ratio of the corrected road rate to the rail freight rate. These parameters give an indication as to the existence of inefficiency in the rail systems. The closer k(a) and k(b) are to 1, the less the degree of inefficiency.

Finally the relevant freight traffic deficit figures were obtained from Railway Industry Council (1987, Attachment 5). This figure for Victoria in 1986-87 was $162 200 000.

The welfare losses are expressed as percentages of the freight deficit to give an indication as to how much the deficit would be reduced by appropriate deregulatory measures. Table 2 indicates that the welfare losses due to Victoria's regulatory regime account for less than 20 per cent of the freight traffic deficit. In otherwords about 80 per cent of the rail deficit might be originating from other freight operations which are not subject to government regulation.

Conclusions based on commercial road rates

In Table 2, bulk liquids are not considered as appropriate for dismantling despite the fact that the captured rents in bulk liquids form almost 2 per cent of the freight deficit. The main reason for this is the seriousness associated with road accidents involving bulk liquids some of which are either inflammable or exceedingly toxic.

The analysis using the proposed model indicates that the regulatory network affecting bulk sands, fertilizers and woodchips need not be changed because the social losses they generate are minimal and their shares in V/Lines revenue earning traffics are small.

The same analysis (see Table 2) leads to the conclusion that the regulations affecting three commodities which form a large share in V/Lines revenue earning traffics should be changed. Furthermore its unlikely that road haulage can dominante on comparative advantage basis in these markets and yet their being open to contestation would provide a needed incentive for efficient supply of rail services.

Conclusions based on corrected road rates

It is worth noting that the conclusions based on a corrected road freight rate which internalises some of the negative social impacts of road haulage are more conservative than those based on the private or commercial road freight rate. Using the corrected road rate only one of the currently regulated traffics needs to be deregulated.

TABLE 2 PARAMETERS USED IN DECIDING WHICH REGULATION TO MAINTAIN AND WHICH TO DISMANTLE: VICTORIA (1987)

Variable	*Bulk grain*	*Bulk coal and briquettes*	*Bulk sands and etc*	*Bulk liquids*	*Bulk cement*	*Fertilizers*	*Wood chips*
Railway revenue ('000$)	55 517	6 378	1 159	9 536	7 158	3 400	1 762
Rail freight rate ($ tonne)	17.47	14.69	2.26	19.87	10.86	13.88	21.49
Tonnes carried ('000)	3 177	434	513	480	659	245	no data
Price elasticity of demand rail							
Low	-0.012	-0.004	-0.004	-0.001	0.004	-0.004	-0.004
High	-0.165	-0.019	-0.019	-0.005	-0.014	-0.014	-0.014
Benchmark rate							
The road rate ($/tonne)	12.67	10.65	1.64	14.41	7.87	10.06	15.58
k(a) = road rate/Fr	0.73	0.72	0.73	0.72	0.72	0.72	0.72
The corrected road rate ($/tonne)	15.52	13.50	4.49	17.26	10.72	12.91	18.43
k(b) = corrected road rate/Fr	0.89	0.92	1.99	0.87	0.99	0.93	0.86
Posner's welfare loss low elasticity scenario with k(a)							
Captured rents ($'000)	14 989	1 785	312.9	2 670	2 004	952	493
Deadweight cs[a] loss ($'000)	24	1	0.1	1.9	1.1	0.5	0.3
Total welfare loss ($'000)	15 013	1 786	313	2 671	2 005	953	493
	(9.21)[b]	(1.10)	(0.19)	(1.65)	(1.24)	(0.59)	(0.00)
Low elasticity scenario with k(b)							
Captured rents ('000)	6 107	510	c	1 240	72	238	282
Deadweight CS loss ($'000)	2	0.3	c	0.3	0.0	0.13	0.28
Total welfare loss ($'000)	6 109	510.3	c	1 240.3	72.0	238.13	282.3
	(3.77)	(0.31)	(0.76)	(1.53)	(0.04)	(0.15)	(0.17)

a. CS denotes Consumer Surplus.
b. The figures in brackets express total welfare losses as a percentage of Victoria's freight traffic deficit of $162 200 000.
c. Denotes that social welfare losses were not estimated out because in this case rail was more efficient than road.

Queensland

The data in Table 3 on railway revenue for Queensland was obtained from Queensland Railways (1987, 22). Figures of tonnes carried were obtained from the same source except for the figure on bulk liquids which was extracted from Hassall (1988). The elasticity figures give the own price elasticity of demand for railway services and are derived from Hooper (1988). The road freight rate was computed from Industries Assistance Commission (1988, 141) in the same manner as the one for Victoria discussed earlier.

Conclusions based on commercial road rates
There is not enough data (see Table 3) to assess the worthwhileness of regulation in most of Queensland railways regulated traffics. All three for which some data is available are characterised by substantial social welfare losses in the Posner sense. Thus all three are recommended for deregulation. Of the remaining regulated traffics it seems that either the low density of traffic, or the serious health and other undesirable attributes associated with their haulage by road, might favour continued regulation of these traffics.

Conclusions based on corrected road rates
In the case of Queensland the use of corrected road rates leads to a complete reversal of the recommendations based on commercial road rates. The social welfare losses of traffic regulation appear to be insignificant. At this point one must repeat that these figures are only indicative. They suggest though that a more detailed study should be undertaken on a commodity by commodity basis to determine more precisely the social welfare losses/benefits associated with the current regulatory regimes in Queensland.

TABLE 3 PARAMETERS USED IN DECIDING WHICH REGULATIONS TO MAINTAIN AND WHICH TO DISMANTLE: QUEENSLAND (1987)

Variable	*Bulk grain*	*Bulk coal*	*Bulk sand*	*Bulk ores*	*Bulk liquids*	*Motor vehicle*	*Dangerous chemical*
Railway revenue ($'000)	57 024	726 806	no data	60 181	no data	no data	no data
Rail freight rate ($/tonne)	12.85	11.85		13.83			
Tonnes carried ('000)	4 436	61 311	no data	4 352	915	no data	no data
Price elasticity of demand (rail)							
Low	-0.012	-0.004		-0.004			
High	-0.165	-0.019		-0.019			
Benchmark rate							
The road freight rate ($/tonne)	9.32	8.59		10.03			
k(a) = road rate/Fr	0.73	0.72		0.73			
The corrected road rate ($ tonne)	12.17	11.44		12.88			
k(b) = corrected road rate/Fr	0.95	0.96		0.93			
Posner's welfare loss low elasticity scenario with k(a)							
Captured rents ($'000)	15 298.1	20 351		16 249			
Deadweight cs loss ($'000)	24.9	113		9			
Total welfare loss ($'000)	15 421	20 464		16 258			
Low elasticity scenario with k(b)							
Captured rents ($'000)	2 851	29 072		4 213			
Deadweight consumer	9		2.4				
Total welfare loss ($'000)	2 852	29 081.3		4 215			

New South Wales

Railway revenue and tonnes carried figures for New South Wales were extracted from State Rail Authority of NSW (1986, 33-34, 73) while the elasticity figures are from Hooper (1988). Ihe benchmark road freight rate was constructed using evidence from Freebairn (1988, 1).

Iable 4 shows that bulk grain and bulk coal in New South Wales are associated with huge captured rents which are a reflection of a high degree of technical inefficiency in the supply of rail freight transport. Thus deregulation is recommended irrespective of whether one uses commercial or corrected road rates. Deregulation in this case will involve capital expenditure in the form of receival facilities for export grain at the relevant ports. Given the extent of captured rents though, it seems as if this once for all investment expenditure would be worth while.

Australian National and Tasrail

Ihe figures for Australian National in Iable 4 were obtained from Australian National Railways Commission (1987, 20, 45).

Unfortunately it has not been possible to obtain data to construct the relevant benchmark and other freight rates to enable one to carry out a social welfare analysis. It is claimed though that the $2.50 per tonne surcharge on grain stored in railway silos but moved to rail-served ports by road which is the regulatory impediment to be assessed for AN's South Australia bulk grain market is of no major consequence for AN's market share.

Nevertheless note that road hauliers transport 53 per cent of grain in South Australia (see Royal Commission into Grain Storage Handling and Transport (1987c, 4, Table 2.1) which means that despite the $2.50 surcharge per tonne the rail charges are such that road transport is still least cost for more than half of the market for bulk grain.

Westrail

Railway revenue and tonnes carried figures for Westrail in Iable 4 were obtained from Holthuyzen (1987, 20) except for the tonnage of fertilizers carried which was obtained from Westrail (1987, 10). Ihe benchmark road freight rate was estimated under the assumption that the average haul for Westrail is about 280 kilometres and that a representative road operator using a 44 tonne road train incurs a road cost of 5 cents per tonne per kilometre.

Again bulk grain transportation in Western Australia should be deregulated on the basis of social welfare losses characterising the industry. Fertilizers should not be deregulated because what is at stake is a small market. Again one should note the reversal in the recommendations based on corrected road rates. Using these rates rail becomes marginally more efficient than road. Unfortunately again there is no data to enable us to examine the other regulated traffics in Western Australia.

TABLE 4 PARAMETERS USED IN DECIDING WHICH REGULATIONS TO MAINTAIN AND WHICH TO DISMANTLE: NSW AN AND WA (1987)

	Bulk grain NSW	*Bulk coal NSW*	*Bulk grain AN-SA*	*Bulk coal AN (Tas)*	*Bulk grain (WA)*	*Fertilizers (WA)*
Railway revenue ($'000)	182 965	286 194	15 821	16 478	93 000	6 549
Rail freight rate ($/tonne)	23.80	8.59	11.50	6.76	16.32	15.59
Tonnes carried ('000)	7 688	33 300	1 375	2 438	5 700	420
Price elasticity of demand (rail)						
Low	-0.012	-0.004	-0.012	-0.004	-0.012	-0.004
High	-0.165	-0.019	-0.165	-0.019	-0.165	-0.014
Benchmark rate						
The road freight rate ($ tonne)	18.80	3.59			14.00	11.80
k(a) = road rate/Fr	0.79	0.42			0.86	0.72
Corrected road rate ($ tonne)	21.65	6.44			16.85	14.65
k(b) = corrected road rate/Fr	0.91	0.75			1.03	0.94
Posner's welfare loss						
Low elasticity scenario						
with k (a)						
Captured rents ($'000)	38 422	165 993			13 020	1 833
Deadweight cs loss ($'000)	49	192			10.9	1
total welfare loss	a	a			13 030.9	1 834
Low elasticity scenario						
with k(b)						
Captured rents ($'000)	16 467	71 549			b	393
Deadweight loss cs ($'000)	36	143			b	0.2
Total welfare loss ($'000)	16 503	71 692			b	393.2
						(0.98)

a. The welfare losses here seem to be exorbitant but this may be due to exaggeration of road efficiency by Freebairn (1988) whose estimates were used to construct this bench market rate.

b. Indicates that these computations were not made because in this instance rail is more efficient than road.

CONCLUSION: FREIGHT

Those markets which need to be deregulated on the grounds of excessive welfare losses associated with the status quo have been identified. For all the traffics for which data was available or could synthetically be reconstructed, welfare losses were observed. A significance test was used to decide which regulations need to be changed and which need not be changed. The conclusion that a regulation need not be changed should not be interpreted to mean that the social welfare losses are zero. The general equilibrium impacts of continued regulation could be substantial. Take the case of fertilisers. The minimum captured rents are as follows: Victoria: $952 000, Western Australia: $1 833 720. While in a multi-billion dollar rail freight transport business these figures are small, this is not necessarily the case for a farmer who operates on a small profit margin but who is forced to reduce that margin because the railway system transporting a key input in the farmer's enterprise is slightly inefficient. What starts off as a tolerable form of inefficiency is passed on to farmers who in turn either have to absorb it in form of lower profits or depending on the elasticities of demand pass it to the buyers of farm products in form of higher prices. For export commodities with well known high price elasticities what starts off as a tolerable inefficiency in transport supply might determine the extent to which Australian produce is or is not internationally competitive.

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