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Future Directions in Railway Management and Regulation

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Abstract: The economic regulation of Australia's railways under the aegis of National Competition Policy has exhibited a fairly standard neoclassical viewpoint of how a firm operates, with basic notions of pricing according to marginal cost and resulting economic efficiencies. The framework, however, misses some of the crucial elements of a railway; most notably the fact that competition happens on a transport network, and the incorporation into regulation of the unique nature of rail's place in logistics chains might lead to some different ideas about regulatory policy. Moreover, some careful consideration about what is being attempted by regulating railways suggests some alternative proposals the current format which are less intrusive. Both ideas have important consequences for the management of railways as well. This paper provides a brief sketch of future paths for research.

INTRODUCTION

The methodological framework of economic regulation of Australia's railways is strongly grounded in neoclassical economics. In essence, regulators endeavour to impose marginal cost pricing on railways on the assumption that so doing will generate technical efficiency hence improve social welfare through Pareto optimal resource allocation. There are, however, a number of issues associated with this approach. Firstly, the models used were originally conceived for an environment where the physical structure of the underlying market was not of great importance; a factory selling into a local market, for example. Competition in rail, and between rail and other modes of transport, occurs across networks, a fact which may materially influence considerations concerning appropriate policy responses. Secondly, the regulatory approach creates a number of problems of its own, such as information asymmetry, the problem of second best and regulatory risk. It is worthwhile considering whether and how these issues might be alleviated. Finally, the approach provides limited scope for considering the underlying aims of regulation and whether alternate means of achieving them exist, particularly as regulation becomes institutionalised through use and its effectiveness becomes blunted.

Section One of this paper outlines the way in which the neoclassical framework of regulation is applied, and some of the problems this creates. Section Two examines some notions associated with the incorporation of the physical network over which competition in rail occurs into the competitive model. Section Three examines some alternate approaches which might be used in some rail contexts in Australia to further the underlying aims of economic regulation. Section Four concludes with some thoughts for ways forward.

RAILWAY REGULATION & THE DIFFERENCES BETWEEN RAILWAYS AND OTHER UTILITIES

With the advent of vertical separation and of third party access rights has come economic regulation of the railway industry. The original intent was for all railways to be regulated, if not by the same regulator, then under a similar set of principles, as occurs in electricity and gas. As different States were reforming their industries at different speeds this was difficult. WA, NSW and Queensland put forward their proposed access arrangements in the late 1990s for the NCC to deem them 'effective'. However, that did not eventuate. Although the ACCC model was to be the standard, at the time the States put forward their proposed regimes, the ACCC model was not yet complete, and the states were not prepared to sign up to a standard which they could not yet see. Whilst the NSW regime was temporarily made ‘effective’ from 1999-2000, this has since lapsed and now none of the states have this status. This has meant that State-based rail access regimes have developed in all States and remain in force, despite the best efforts of both governments and industry lobby groups to achieve greater consistency. The various access regimes are shown in Table Two.[1]

Table Two: Australian Rail Access Regulators

Regulator	Jurisdiction
ACCC	National track and NSW non-urban track
Queensland Competition Authority	Queensland
WA Economic Regulation Authority	WA south west (WestNet Rail and PTA track), with possibility of regulating Pilbara railways
Independent Pricing and Regulatory Tribunal (IPART)	NSW (metropolitan area only)
Victorian Essential Services Commission	Victoria
South Australian Essential Services Commission	South Australian track and Tarcoola-Darwin railway

There are differences between the regulators, but in general they operate in much the same way. Each may determine ‘floor’ and ‘ceiling’ revenue levels for the infrastructure under its jurisdiction, and these are based on a cost-based ‘building-block’ model. The form of this model is different in each jurisdiction, but the differences are not substantial. The most important differences are the way in which asset values are calculated (all adopt the DORC methodology, except the WA ERA which uses the GRV method), what is included in the asset base (South Australia includes government assets and land at historical cost, Queensland includes land at a DORC value and the other regimes include neither) and the ways in which common costs are allocated across users. All regimes have adopted a ‘negotiate-arbitrate’ model, though each has its own process to trigger regulatory intervention, with some acting prior to an access request and setting general principles of access, and some acting ex-post, only when access negotiations have failed. Some (the ACCC and QCA) have reference tariffs to guide negotiations, but only the new Victorian regime makes them mandatory.

The basic model in all cases is the standard neoclassical economic model of cost minimisation. In the absence of definitive knowledge about the actual cost structure of the firms involved, the regulators construct a ‘world’s best practice’ model of the railway being regulated, and then require that the railways earn no more revenue per line than this ‘world’s best practice’ benchmark dictates should occur. The logic behind this approach is that, in a perfectly competitive world (the effects of which regulation endeavours to emulate) only the least cost providers would remain, and prices would be set according to their marginal costs. There are, however, some problems associated with this approach. These are outlined below

Problems with the Neoclassical Model as Applied to Railways

The discussion below covers some of the issues associated with the standard neoclassical model as applied to railways.

Competition Occurring on a Network

Recent mergers in the rail industry have highlighted the importance of the physical shape of the railway network to the economics of the industry. A terminal on the outskirts of a city does not have the same economic status as a terminal adjacent to a port. Likewise, a rail link running west from a town might have entirely different economic characteristics to a railway

[1] Not including the NCC.

running east and the former is rarely a substitute for the latter. The physical shape of the network can become particularly important when mergers cross modes, such as the Toll-Patrick merger, or where competition from different modes can change conclusions on market definition. The physical shape of the network can also be important for understanding how important an asset, say a single rail link, is for maintaining competition in a network, which can be crucial in such situations as Section 87B undertakings involving asset divestments under the *Trade Practices Act*.

The study of locational effects on competition has a long history, reaching back to the models of Hotelling (1929) and Hoover (1937). Pal & Sarkar (2002) is a recent example of the legacy of Hotelling's model of competition along a line, whilst Combes & Linnemer (2000) is a recent application of a model based on Hoover. Gupta, Lai, Pal, Sarkar and Yu (2004) is an example of the line model extended to a circle, and McLeod, Norman & Thisse (1988) extend the model to a uniform two-dimensional space. There has also been some work examining oligopolistic competition operating across a network, particularly in the study of electricity markets (see for example Hobbs, 1986 and Marcotte, 1987). Very little of this has percolated through to regulatory economics, and almost none has been used to inform the regulation of transport infrastructure in Australia; at present, assessment of the networked nature of assets in undertaken on an ad-hoc, case by case basis, rather than within a more general framework.

Within the context of examining how networks influence competition in a railway or logistics chain, there are a number of avenues of investigation. These include:

- Network shape and market power.
- Understanding the nature of strategic resources in a physical network.
- Understanding oligopoly constrained to a physical network.
- Strategic resource accumulation and product market outcomes.

These are explored further below.

Informational Asymmetries

Perhaps the most pervasive issues associated with economic regulation is that of the information asymmetry. Put simply, it is impossible for a regulator (or indeed anyone external to the firm) to accurately observe the internal cost structure of the firm and, more particularly, its marginal costs. This means there is some uncertainty in exactly what the price should be, giving regulated firms a strong incentive to overstate their costs to the regulator in order to capture some market-power rents. It also means that economic regulation inevitably incurs costs as it hires the services of experts to reduce the information asymmetry. These costs include not only the fees to consultants engaged, but also a degree of regulatory capture and potential stasis as an industry develops with a decided interest in maintenance of the status quo, and a degree of regulatory gaming as various parties hire different experts to advance different lines of argument.

The Problem of Second Best

The reason for regulation is that prices in a monopoly industry will deviate from their efficient and social-welfare maximising level, resulting in allocative inefficiency. It might be assumed (and indeed is assumed in regulatory policy, at least implicitly) that moving prices in the monopoly industry would result in an increase in welfare for the society as a whole. Unfortunately, this is unlikely to be the case, as Lancaster & Lipsey (1956) suggest in their theory of second best, which shows that, if one has situations where prices deviate from marginal cost in numerous industries, then the situation where fewer prices are at marginal cost does not necessarily result in lower social welfare than a situation where more prices are at marginal cost.

In fact, from a social welfare perspective, if there are several industries where prices are above marginal cost and one of these has its pricing controlled by government, the optimal response is to set the price of the government controlled firm above or below its marginal cost depending upon whether it is a substitute or complement to the other goods, with the margin being dependent on the margin for the other good. The rationale for this is that, since the other goods are priced above marginal cost, resources are substituted away from them and hence one can only achieve allocative efficiency if the government controlled substitute is also priced above marginal cost or the government produced complement is priced below marginal cost, which makes the alternate good more attractive (Turvey, 1971 and Webb, 1976). Unfortunately, in a real world situation, the number and nature of complements and substitutes can be difficult to ascertain, and this may explain why regulators have ignored the theory of second best. However, the fact that solving the problem is difficult does not necessarily mean that the problem is unimportant. Examining approaches which might obviate the problem of second best, or at least allow policymakers some understanding of its extent, would be very useful.

Regulatory Risk

Railways are reticent about making investments which are risky because of the potential that a future regulatory decision, made when the future has happened and hence the risks at the time of investment have disappeared because demand is known, might apply an efficiency benchmark which removes the upside potential of the risky decision, when this would not occur in the event of the downside risk becoming reality. Railways might seek to mitigate this by sharing the risk with their customers, but customers are unwilling to commit capital to the project for the same reason; their future rival might be able to use the infrastructure without having incurred the capital cost. The resulting catch-22 reduces investment. The current regulatory framework attempts to mitigate this risk by offering ‘regulatory holidays’ for some greenfields projects for which the issue is deemed to be significant. This is a useful approach when used sparingly, but could not be widespread in its application as it involves the cessation of regulation. It would be better if regulators could actually determine the size of regulatory risk and solutions to it within a more generalisable framework.

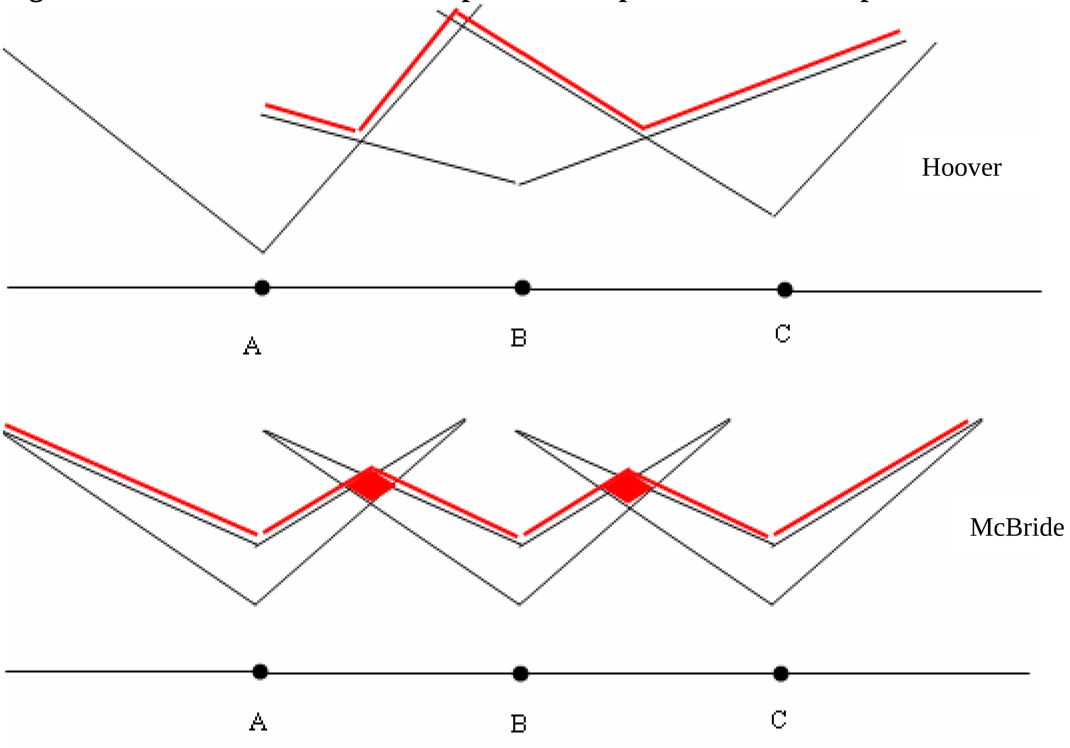
COMPETITION ON NETWORKS AND RAILWAYS IN LOGISTICS CHAINS

Networks affect railways in two ways. Firstly, the physical nature of the network influences the act of competition between two railways (or between a railway and a different mode of transport) and secondly, the structure of prices created as railways endeavour to price discriminate to cover sunk costs influences the evolution of the industry, most particularly when government restrains some prices, through politics or regulation.

The Behaviour of Competition in Networks

The physical shape of networks can influence competition in two ways. Firstly, conceptualising a marketplace as a connected network of competing firms provides a framework by which competition occurs between those located near each other more strongly than between those located at a distance, but still allows for prices to be transferred through the network. For example, railways based in each of the states offering transport services into adjacent states compete with each other directly, but the prices provided in one corner of the country will be transferred across the country through a process of bilateral competition. Hoover (1937) is a seminal work which considers how localised monopoly will mean that those closer to a firm will be charged higher prices than those at a distance. McBride (1983) takes an opposite view, considering transport costs as an addition to production costs and hence has monopolists, charging the monopoly price at all locations where it is possible to do so. Under McBride’s model, monopoly prices prevail, except at the margins of markets, where monopolists meet and compete, charging lower prices. Figure One shows the different outcomes of each approach.

Figure One: Two Models of Monopolistic Competition with Transport Costs



In the top diagram, the black lines represent marginal cost curves. The marginal cost of production (or production including delivery) increases with distance, but because the competitive firm prices according to the marginal costs of its rival, prices (the red line) increase the closer one gets to the firm. In the bottom diagram, the top line in each "V" shape is the marginal revenue and the bottom is the marginal cost. Pricing relates to marginal revenue where the firm has market power, but where it overlaps with the market of a rival, the pattern of pricing becomes indeterminate (the red diamonds), and depends upon the nature of competition. The two conceptions of competition are not unrelated. Hoover's (1937) model does not consider upper limits on the ability of the firm to price according to the marginal costs of a rival,[2] where a rival's marginal cost is above the monopoly price for a given market. In reality, prices might be limited by the monopoly rents available in a given market, and the firm might price at the maximum of its rival's marginal cost and the monopoly price at each point of a given distance from the firm. This would result, in the bottom diagram, in the prices following the red lines and the bottom edge of each of the red diamonds. The monopoly rents are the areas between the marginal cost curves and the prices. They can be calculated via simple geometry, once one knows the angles each of the curves makes with the horizontal and the physical distance between each firm.[3] The entire physical transport network can be drawn as a series of dyads on a graph in a manner similar to that above, and the rents and marginal costs of rivals be incorporated into the reaction functions of each firm.

Analysing markets in this fashion is useful for policymakers, because it allows one to observe changes in the market. For example, in the simple case of Figure One, a policymaker would

[2] As presented it does not do so. Hoover makes mention of upper bounds, but these are not specifically related to marginal revenue curves.
[3] In a more general framework, where the curves are not straight lines, the differences between the integrals of each curve will provide the monopoly rents.

be loathe to allow firm B to merge with either firm A or firm C, as this would substantially increase monopoly rents. However, the policymaker would be willing to allow firm B invest in cost reducing technology. This would not help those customers closest to B, but it would increase the size of the diamonds between B and A and B and C, increasing competition in these areas. The policymaker would also be interested in any entry which occurred in between any of the three nodes, with the greatest interest being reserved for entry which occurs at the point where competition is currently occurring between two adjacent nodes.

The second way in which one can incorporate a study of competition over a network into the analysis is to consider not firms competing with rivals as above, but rather networks of the strategic assets in the overall transport network. For example, one could ‘draw’ the rail network of Australia including in the graph all of the strategic rail links and terminals. One could then consider ownership of each of these pieces of infrastructure, and look at the shapes of companies which result. One could, of course, also consider the broader logistics industry, and include ports, airport slots and road links (or the right to use such links, where the links themselves are owned by government and are public goods). The shapes of the companies on this network of assets could provide important clues as to the exercise of market power. For example, where they are ‘closed’, islanding certain assets from connections with the broader network (as in the Chinese game of “go”) then this might indicate the potential exercise of market power. Similarly, where a firm controls a number of strategic assets which are strongly linked with the remainder of the network or which form the only links between parts of the network (Burt, 1992, refers to these as structural bridges), then this could represent an indication that the firm could prevent price signals from travelling across the network. The modelling framework might also allow one to consider which strategic assets are likely to be considered most valuable by the industry, and to design better programmes of asset relinquishment under Section 87D of the *Trade Practices Act*.

The above discussion merely scratches the surface of the approaches which might usefully be added to the standard neoclassical model used by regulators, in order to take into account the networked nature of competition which occurs in the industry. It does, however, suggest a number of useful avenues for further investigation.

Some Potential Consequences of Price Regulation With Ramsey Pricing

A well known consequence of industries with high fixed costs is the efficiency of Ramsey pricing as a means of allocating such costs across customers based upon their elasticity of demand. Railways, with their high sunk costs, were using Ramsey pricing more than half a century before it was discovered by economists, as attested to by the voluminous rate-books produced towards the end of the 19th Century.

One can think about patterns of cross-subsidisation as a network, whereby the rents appropriated from a customer with a low elasticity of demand are apportioned between a number of other customers with high elasticities of demand. Jackson & Wolinsky (1996) present a model of network evolution whereby nodes make links according to the utility each link provides. If one considers a link to be “service A cross-subsidises service B” and the utility associated with the linkage the amount of fixed costs accounted for by that cross-subsidisation, then one can study how (and if) the pattern of cross-subsidisation might evolve towards a stable equilibrium.

This is useful for a number of reasons. One could study what happens when a particular transport task is removed from the network by competition from other modes of transport. Conversely, one might study how best to allocate government subsidies within the network such that the resultant pattern of cross-subsidisation leads to competitive neutrality between road and rail (both pricing at marginal cost) for task where they compete. From a regulatory perspective, one could examine the effects of fixing certain prices for services (say, the price of passenger services) on the overall ability of the network to find a stable equilibrium in the price structure. Historically, this has been a significant issue. In the UK, the set of maximum prices created in 1893 had proven so untenable due to changing patterns of demand that, by 1920, they had to be completely reviewed (Wills-Johnson, 2006). In the US, such wholesale reviews were never done, and eventually the system collapsed because some transport tasks left rail altogether and others (particularly passenger services) were allowed few price rises by the Interstate Commerce Commission. Under the current system of access regulation in Australia, revenues, rather than prices, are capped, but there have been moves towards establishing a system of 'reference prices' (particularly in Victoria, where it is mandatory), and it would be useful to consider the effects of such a regime on the long-term ability of the rail industry to fund its fixed costs.

THINKING DIFFERENTLY ABOUT THE MECHANISMS FOR ACHIEVING THE GOALS OF REGULATION

The goal of economic regulation is not simply the creation of competition for its own sake, but rather the maximisation of social welfare. It is held that, through making prices more efficient (ie – closer to marginal costs), regulators might allow for a more efficient allocation of resources and hence approach Pareto optimality. However, a narrow focus on how to get prices closer to marginal costs distracts policymakers from other approaches which might maximise social welfare. There are many examples whereby one might achieve optimal results through non-regulatory means. In many cases, this requires policymakers to step outside the confines of neoclassical economics. Two such examples are considered below.

Cost Allocation and Coal Chain Pricing

The basic problem in the coal chains is a catch-22; the railways are not prepared to risk capital up-front on sunk cost investment that might not be fully utilised without pre-commitment from the mines who would form its major customers and the mines are not prepared to make such pre-commitment without some certainty about future prices and demand.[4] Regulation can exacerbate the problem because future regulatory decisions which may reduce prices are made with information about future demand which is not known by current investors. This regulatory risk makes railway owners wary of risky investment and mines wary of contributing to such investment, as it potentially cuts off the upside risk associated with investment whilst leaving the asset owner to face downside risk.

The catch-22 arises because of a fundamental externality in the coal chains; due to an asymmetry of information between the railways and the mines, the railways cannot know with certainty the (heterogeneous) costs of the mines they serve and thus cannot price to recover fixed and sunk costs efficiently. In the short term, this advantages the mines because the inability of the railways to distinguish between low and high cost mines means each mine can keep more of the resource rent which results from having production costs below world market prices. However, in the longer term, the mining industry as a whole suffers through lack of investment.

The externality problem is not solved by introducing above-rail competition as a new entrant faces the same information asymmetry as the incumbent. It is solved by finding some way for the mines and the railways to make credible commitments to each other concerning funding for future infrastructure. At present, this is occurring through the use of coal-chain agreements. These, however, are not a market-based solution, and are potentially conducive to collusion if their use is sustained in the longer term. The ACCC, realising this, has only

[4] Throughout this section, reference is made to railways. Ports also form part of the coal chains, and the method of analysis could be equally applied to them, to assist in the funding of port expansion.

provided limited exemptions from the *Trade Practices Act* to cover them, and hence it is difficult to see them as a sustainable solution.

An alternative approach to overcoming the externality which does not require an additional layer of management, nor any regulatory involvement comes from the game-theory literature and is called incentive-compatible pricing, coined by Baron & Myerson (1982).

The theory surrounding incentive compatible pricing has developed from an examination of what it is that gives a firm an incentive to reveal the truth about its cost structure to a regulator. A regulator cannot accurately observe the costs of a firm from outside that firm (a phenomenon known as an information asymmetry) and a firm with lower costs which cannot be distinguished from a firm with higher costs has no incentive to reveal its lower costs an forgo the rents associated with them (Laffont & Tirole, 1993). The question is whether these effects are inevitable in the same way as Heisenberg's Uncertainty Principal suggests a particle's location and motion cannot be simultaneously deduced, or whether they can be overcome. Incentive compatible pricing suggests that they can be overcome with the right incentives, and suggests two ways in which firms can be provided with incentives to reveal their true costs:

- They can be provided with subsidies related to the increase in consumer surplus that comes from a voluntary reduction in price, which gives a strong incentive to reduce price to marginal cost almost immediately and thus provides efficient pricing (see Sappington & Sibley, 1988).
- They can be given a choice of contracts reflecting different output-price pairs and their self-interest will lead them to a choice which reflects their true costs (see Baron & Besanko, 1987).

The latter approach is of interest here. A regulator will not know the price structure of each of the firms in question, but might know something about the distribution of likely cost structures for different ranges of output. For example, it might know what the lowest and highest costs would be for different ranges of output. The regulator can then create a menu of price and quantity combinations which match the distribution and offer these to the firms, who then choose a favoured option from the menu. The mechanism works because of the contract mechanism; if a firm is low cost and endeavours to mimic a high cost firm, it will be penalised by the lower quantity of output it is allowed to produce.

The key question is how one determines the distribution of costs and outputs. There may be extant technical expertise which is able to provide rough ideas on cost for different levels of output, which is sufficient to develop the distribution. A simpler alternative is to ask the firms themselves. Smith and Tsur (1997) show that asking firms works can work, because if all other users are telling the truth an individual has no incentive not to do so. Since this applies to all firms, the result is truthful revelation. The essence of Smith and Tsur's approach comes from the earlier theoretical work of Myerson (1979) into 'Bayesian Incentive Compatible Mechanisms' by which an arbitrator in a game can force players to reveal information about their types, and might be summarised by the following three steps, which are known to all players before the process begins:

1. The regulator asks all of the users of the service to submit their costs and the quantity of the service they will use.
2. The regulator then develops a model of the distribution of cost-output combinations and from this a set of cost-output pairs which it offers back to the users in contracts for use of the service.
3. The users choose the contract which suits them best, which need not necessarily be their reported costs in step one.

With such a seemingly simple approach, it might seem obvious to ask why it has not been tried before in regulation. An important reason is that it relies on contracts, whereby firms commit to produce a certain amount of output for shipping. Regulation does not operate with contracts and indeed the main aim of price and revenue cap regulation is to control price without limiting output. However, railways sign contracts with their mining customers and, moreover, have exactly the same problems with information asymmetry that a regulator would. Given the finite number of mines involved and the fact that there is only one or two railways and one or two ports in each chain, they would seem to be an ideal test case for Smith and Tsur's (1997) approach.

Such an approach has yet to be trialled in Australian railways, and it shows some promise in being able to overcome the information asymmetries associated with railway investment. There is also not necessarily any conflict between the methodology above and economic efficiency, as the discussion below shows.

Fairness as a Mechanism of Price Control

The conventional framework for analysis in regulation is that of economic efficiency. As discussed above, it raises several issues, most notably information asymmetries, issues of second best and regulatory risk. One question which is almost never asked is whether the results regulators desire (efficient prices) can be achieved in any other way. In a certain sense, they can, using notions from game theory. Aumann (1964) proves that the core of a continuous game (one with an infinite number of players, mathematically equivalent to perfect competition) coincides exactly with the equilibrium of a competitive market. Following this, a large literature has developed, extending the example to games with finite numbers of players (which find that the core contains the competitive market equilibrium and shrinks around it as the number of players becomes larger) and to games without transferable utility (see Mertens & Sorin, 1994, for a survey). Aumann and Shapley (1974) show that the Shapley Value and the core coincide at the competitive market equilibrium for a continuous game, and the Shapley Value asymptotically approaches (for both transferable and non-transferable games) the competitive equilibrium as the number of players increases (Hart, 1977). Both Farrell (1970) and Shitovitz (1973) use the Shapley Value to show that games where two or more players have a large weight and the remaining players have none converge to the competitive equilibrium as the number of powerless players increases and the number of powerful players stays fixed. This result, which seems to contradict the findings of neoclassical economics, obtains because both authors allow for coalitions to form amongst the powerless players which can then allow them to collectively gain advantage against the powerful players. Unions are one real-world example where this model has application.

The Shapley Value is important because it links to the resource allocation of perfect competition and because it is widely used as a standard of fairness in game theory. Its underlying notion that the rewards one should expect from playing a game are related to what one brings into the game are intuitively appealing as a notion of fairness. In cost allocation problems, the fairest way of apportioning costs is the Shapley Value. For example, Littlechild and Owen (1973) examine fair cost allocation mechanisms for the funding of a runway when that runway is to be used by aeroplanes needing different runway lengths. The solution they derive seems intuitively fair; all aeroplanes should share equally in the costs of building a runway which could serve those aeroplanes needing the shortest runway, all bar these short-runway planes should share equally in the marginal costs of extending the runway to accommodate the next shortest class of planes, all bar the first two classes should share in the marginal costs of the next shortest class and so on until one has a runway of sufficient length that all aeroplanes involved can use it. Upon making such calculations, Littlechild and Owen (1973) found that their cost allocation methodology corresponded exactly with the Shapley Values of the players (planes) concerned in a cost allocation game.

Young (1994) presents a survey of work in this regard in relation to the sharing of costs, but perhaps of greater interest to the Australian railway industry is the work of Fragnelli, Garcia-Jurando, Norde, Patrone & Tijs (1999) who adapt Littlechild & Owen's (1973) model to devise a fair means of charging for railway infrastructure. Such work has yet to be undertaken in Australia, but it would be a relatively simple extension from the work of Fragnelli et al.

Since fairness (via the Shapley Value) can be shown to give the same outcome as the perfectly competitive allocation of resources in a neo-classical economic model, it serves as a potential replacement for or augmentation to that model in regulation. What use, apart from academic interest, would using fairness be? There may in fact be many applications within the rail industry for the very simple reason that many issues need to be encapsulated into contracts, and fair treatment is crucial in successful contracting. One example is the treatment of overpayment rules. It would be a relatively simple matter to establish overpayment rules via a Shapley Value approach and incorporate this into contracts signed between above and below-rail parties. Both parties to the agreement could be assured that they were being treated fairly, and the regulator could not argue that the results were inefficient, because allocation mechanisms via a Shapley Value approach are the same as the outcomes which are obtained if neoclassical economics is used as the basis. The main difference lies in the information required; the Shapley Value requires less. Another example which often arises in the railway context is that of new infrastructure and the sharing of costs associated with it. It would be relatively simple to design a rule around the Shapley Value which fairly shared the costs of building infrastructure desired by a particular customer, and allowed for the fair sharing of any subsequent demand which might follow from new entrants. Again, the regulator could brook little objection given the coincidence of game theoretic and economic resource allocation results.

In a general sense, one could utilise notions of fairness to study the ways in which contracts between above and below rail operators could be improved, one of the key issues identified in the recent Productivity Commission review on land transport pricing (PC, 2006). Williamson (1975, 1979, 1989) and his Transaction Cost Economics (TCE) has been widely used to examine the 'natural' extent of firms, based upon the sum of production and transactions costs and it provides a useful framework for considering when a given transaction might be better done in-house rather than being contracted for in a marketplace. Yvrande-Billon (2003) and Affuso and Newberry (2002) have used the TCE framework to examine the formation of contracts in British railways, mostly between above-rail operators.[5] No such work has been undertaken in Australia, despite the fact that many aspects of railways suggest, from a TCE perspective, that a vertically integrated structure might be preferred.

Unscrambling the reform process in Australia to allow railways to re-integrate might be impractical, but a useful avenue of study could be to examine where contractual difficulties might be expected to arise using a transactions cost economics approach,[6] and then to look to some of the game theory work on fairness, particularly in the field of cost allocation, to examine how contracts might be improved. Incorporating the Shapley Value into contracts involving asset investment by both above and below rail operators, for example, seems a useful approach to take in this regard.

CONCLUSIONS

This paper endeavours to sketch out, in very broad and rough strokes, some possible avenues for future research which might usefully augment the current way in which railways, and indeed networked industries more generally, are regulated and managed. The extensions are grouped under two headings:

[5] The rail franchise contracts in Victoria seem an obvious application of this work.
[6] Our survey of the industry, currently underway, is a precursor to such work.

- Networks and their role in railway competition.
- Game theory and the study of inter-firm interaction (not just collusion or competition).

Both extensions provide a number of potentially useful insights which might better inform regulation, management and policy in the railway industry. They also provide substantial scope for the industry to better understand itself and, more particularly, to understand the economic interactions between its component parts as well as it understands the engineering interactions. This assists in providing firm foundations for the future growth of the industry.

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