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REPORT

Rail access pricing framework for South Africa

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Abstract: The South African Government has identified private sector participation as vital for reviving rail. This is reflected in policy. A review of private sector participation in rail and other industries in Africa indicates that friendly policy is insufficient to attract the private sector. Detail around potential opportunities, a transparent procurement process, capacity within government to engage with the private sector and the establishment of an economic regulator are seen as the necessary next steps.

This report develops a strategy for encouraging private sector participation in rail, based on a ten-step framework building on the lessons learnt from the literature review, interviews, and financial and economic considerations. It identifies the areas of rail where the private sector could participate and prioritises them from the perspective of each participant based on their motivations for (or against) participation. Mechanisms and their implementation are tailored for these prioritised areas and conditions identified for successful implementation. Criteria to identify potentially successful projects are listed and access principles are considered throughout.

Key words: private sector participation, rail, strategy, prioritised opportunities, mechanisms

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About the project

Southern Africa –Towards Inclusive Economic Development (SA-TIED)

SA-TIED is a unique collaboration between local and international research institutes and the government of South Africa. Its primary goal is to improve the interface between research and policy by producing cutting-edge research for inclusive growth and economic transformation in the southern African region. It is hoped that the SA-TIED programme will lead to greater institutional and individual capacities, improve database management and data analysis, and provide research outputs that assist in the formulation of evidence-based economic policy.

The collaboration is between the United Nations University World Institute for Development Economics Research (UNU-WIDER), the National Treasury of South Africa, the International Food Policy Research Institute (IFPRI), the Department of Monitoring, Planning, and Evaluation, the Department of Trade and Industry, South African Revenue Services, Trade and Industrial Policy Strategies, and other universities and institutes. It is funded by the National Treasury of South Africa, the Department of Trade and Industry of South Africa, the Delegation of the European Union to South Africa, IFPRI, and UNU-WIDER through the Institute's contributions from Finland, Sweden, and the United Kingdom to its research programme.

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REPORT

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Abstract: The bulk of the South African freight rail network comprises a state-owned, vertically integrated operator, which essentially does not allow freight rail competitors to access its network (some passenger access arrangements are in place). Going forward, the policy position of government is that access should be allowed on this network, as market entry via access rights has the potential to increase the efficiency and productivity of the rail system, via increased price and quality contestation. However, the pricing of third-party access also holds significant risks, particularly as regards the sustainability of investment in the rail infrastructure. The report looks at international practice in rail access pricing systems in order to develop a proposed framework for rail access pricing in South Africa. Particular attention is paid to the need for price differentiation to improve system efficiency, and how such price differentiation should be implemented.

Key words: freight rail, pricing, infrastructure, network, efficiency, South Africa

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Executive summary

Access to South African rail networks is currently quite limited, with both the state owned freight operator, Transnet Freight Rail (TFR), and the state-owned passenger rail operator, Prasa, being vertically integrated and unregulated. Going forward, the policy position of government is that access should be allowed to the rail network, given its potential to increase the efficiency and productivity of the rail system, via increased contestation on price and service quality. However, access provision also holds significant risks, particularly as regards the sustainability of investment in the rail infrastructure. To a substantial extent, the ultimate outcome of allowing competitive access to the rail network will be predicated on whether the right pricing structure is implemented.

In perfectly competitive markets, firms compete prices down until they just cover the marginal cost of service provision. At this price, the level of a good or service provided is also socially optimal. Unfortunately, this theoretical pricing model breaks down in high fixed cost industries such as rail. If prices in rail are set at marginal cost, they will only cover the operational costs of providing the service, and thus will not cover the fixed costs of the network. However, if prices are raised to cover fixed costs, then the amount of rail services provided will fall below socially optimal levels.

The solution used in many countries is to subsidize the fixed cost of the network. However, where subsidization is not affordable, pricing systems need to be able to spread the cost of infrastructure between customers in a manner which reduces sector efficiency as little as possible. The literature suggests that there are three cost concepts which provide a useful framework when thinking about cost recovery in rail. The first is marginal cost. It is fair and reasonable to expect any beneficiary of a service to pay at least enough to cover the additional costs generated when providing that service. Marginal costs can thus be regarded as a floor below which access prices should not fall.

At the other end of the scale is the concept of stand-alone cost (SAC), which originated in rail regulation in the United States. Price regulation in US rail happens fairly infrequently, and is done only to protect captive shippers from monopolistic pricing. In those cases, prices will be constrained to the price that a hypothetical, efficient competitive entrant to the market would charge.[2] This hypothetical entrant would need to build their own network from scratch, and then set its prices at a level sufficient to cover the cost of this new network — in other words, the stand-alone cost,[3] which can regarded as a ceiling above which price increases should not be tolerated. In practice, however, it is unusual for rail operators to be able to raise prices to a level consistent with SAC, because intermodal competition from other freight types often constrains pricing.

The third cost recovery concept which is of importance is where prices are set at a level sufficient to allow the network to make a normal level of profit, and result in investment incentives sufficient to keep the network sustainable. This in turn depends on how assets are valued, which drives the required return on assets. Regulatory precedent suggests that there is no single 'right' way to value the assets of a regulated firm. The context of the firm itself, and the sector in which it is located, must be taken into consideration.

[2] Wilson and Wolak (2016).

[3] Baumol and Willig (1998).

Internationally, it is rare for rail to have sufficient pricing power to set access fees high enough to cover the depreciated optimized replacement cost (DORC) valuation of fixed assets. Where rail freight systems do make profits, it is typically on a historical asset valuation rather than a DORC basis, and this would be an appropriate asset valuation methodology for South Africa as well.

Given the high fixed cost nature of rail, it is critical to maximise traffic volumes in order to efficiently spread costs. Ramsey-type pricing systems are specifically designed to achieve this, through the use of price differentiation. Prices are set in inverse proportion to customer demand elasticity, so captive customers with low price elasticities receive high prices, and vice versa. Price differentiation allows the infrastructure manager to maximise the volume of freight carried, because prices can be set low enough to make rail attractive to customers who would otherwise use other modes of transport. While these customers do not cover a 'fair' share of fixed costs, they nevertheless do cover some fixed costs, and thus help to spread the burden of fixed costs among a wider customer base.

This kind of price differentiation is recommended for South African rail access systems. Safeguards will need to be put in place to prevent abusive pricing practices, and to ensure that the competitive playing field between access seekers remains level. These competitive safeguards need to include the following elements:

- A price floor below which access prices cannot fall – marginal cost pricing.
- A price ceiling above which access prices cannot rise – access prices at full cost recovery on a DORC basis.
- A commitment to setting the prices that comparable access seekers are offered at the same level across the network (with some network segmentation allowed).

To start off third-party access pricing systems, a pricing framework which limits the IM to the floor and ceiling prices should be sufficient to provide a reasonably efficient market outcome. Going forward, a more formal regulatory approach with more oversight over the structure of prices will be needed. The recommended pricing methodology is a required revenue approach, where required revenue is set with reference to the depreciated historical value of assets. Ideally the price regulation method should also include some incentives for achievement of efficiency metrics. Should the IM be required to open network segments which are not feasibly commercially sustainable, it would be preferable to have these network segments financed by state subsidies rather than by cross-subsidization from more profitable network segments.

1 Introduction

At present, the largest South African rail operator is Transnet Freight Rail (TFR), which is state owned, vertically integrated and, with only one or two minor exceptions, does not allow freight rail competitors to access its network. The primary passenger rail operator, Prasa, is provided with access to the TFR network to run both metro and intercity passenger services, but the rail access charges are set primarily by TFR, and significant unresolved disputes characterise the access relationship. A small number of other access arrangements have been concluded with luxury passenger rail service providers and steam club enthusiasts.

Going forward, the policy position of government is that access should be allowed on the TFR network to freight competitors. In passenger rail, existing access arrangements need to be improved, and going forward new entrants may also be of interest (although more policy work on what this would look like is still needed). Market entry via access rights to the existing network has potential to increase the efficiency and productivity of the rail system, via increased contestation for customers as regards the price and quality of rail service. However, it also holds significant risks, particularly as regards the sustainability of investment in the rail infrastructure.

To a substantial extent, the ultimate outcome of allowing competitive access to the rail network will be predicated on whether the right pricing structure is implemented. Set the price too low, and the operator will not be able to maintain the asset base. Set the access price too high, and new entrants into the market will be unable to effectively compete with the incumbent. Similarly, the structure of access prices has great potential to incentivise operators to improve or damage system efficiency. Last but not least, the manner in which prices are regulated are typically intrinsically linked to policy choices, for example as regards market structure, direct and indirect subsidization, and industrial policy objectives. These implications and trade-offs need to be understood and acknowledged when determining pricing policy in order to avoid unforeseen outcomes, and to ensure that proposals are in fact implementable.

In this report I will propose a framework for rail access pricing in South Africa. I begin by examining international practice in rail cost recovery, as well as what practices have been developed by South Africa regulators in the airports, pipelines and ports sectors. Following from that I will review international practices in the design of rail access prices. Finally, the report will set out a proposal for South African rail access prices. In practice, the finalization of such a policy will need to have reference to both government policy and regulatory strategy — however, by setting out the practical implications of such policy decisions at this point, some insights may be provided to policymakers going forward.

Much of the costing data necessary to produce an accurate rail access price regime is fairly underdeveloped in the South African rail environment. As a result, the proposals developed should be considered a starting point for rail access pricing, which will hopefully be refined in coming years by the Transport Economic Regulator, which will be launched after the planned enactment of the Economic Regulation of Transport Bill.

This research is conducted in support of Operation Vulindlela, an initiative of the South African Presidency and National Treasury, intended to support the implementation of structural reforms across a number of sectors. the implementation of third-party access in rail has been identified as a potential high impact reform by Operation Vulindlela. The author was also involved in the process of drafting the Economic Regulation of Transport Bill.

2 International practice in rail cost recovery

In perfectly competitive markets, theory suggests that competition between firms will decrease prices until they just cover the marginal cost of service provision (that is, the cost associated only with producing the very last unit of goods or services produced). At this price, the level of a good or service provided is also socially optimal. Unfortunately, this theoretical model of pricing can be difficult to apply in high fixed cost industries such as rail. The bulk of the cost of service provision in rail comprises fixed costs, associated with the substantial historical and ongoing investments needed to maintain the rail track network. If prices in rail are set at marginal cost, they will only cover the operational costs of providing the service, and thus will not cover the fixed costs of the network. However, if prices are raised to cover fixed costs, then the amount of rail services provided will fall below socially optimal levels.

The solution used in many countries is to subsidise the fixed cost of the network, to a greater or lesser extent. As a rule of thumb, (Nash et al. 2005) suggest that marginal costs in rail amount to approximately 15–20 per cent of total costs. In a survey of 23 European countries, they furthermore found that while subsidization is widespread, it is by no means universal. In Norway and Sweden, subsidization is extensive, and it is likely that not even the full marginal costs of rail are covered by infrastructure charges. Only three countries in the sample aim for total cost recovery, namely Estonia, Latvia and Lithuania. The rest of the sample falls somewhere in between, covering marginal costs and some proportion of fixed costs.

Given that TFR is a division of a corporatized state-owned entity, which is expected to be self-sustaining and is not provided with any direct subsidies, it is reasonable to assume that South African rail access charges should aim to recover both marginal and fixed costs of service provision. The access pricing precedent established in countries such as Norway and Sweden is thus less relevant than in those countries where at least some proportion of fixed costs are also recovered.

On the whole, however, rail access pricing precedent in the EU is useful when considering the way forward for South African rail. The EU package of rail reforms aimed to improve the ability of rail operators to access each other's networks, and did so in a way which was fairly neutral as to the degree of vertical integration of the infrastructure manager. In addition, allowance has been made for fixed cost recovery where financially necessary.

In contrast, the market structure of rail in many other areas of the world does not lend itself well to analysis of rail access pricing as a mechanism for introducing competition in South Africa. For example, in Russia the primary form of competitive entry in the rail system has been the introduction of privately owned wagons, and infrastructure and locomotive operations remain a vertically integrated monopoly.[4] Access pricing is thus not a feature of this market. Conversely, in Japan, the rail system is dominated by passenger trains, and freight historically operated at a loss, cross-subsidised by passenger services.[5] This is the opposite of the situation in South African rail, which is dominated by freight trains, and where freight is more likely to be profitable. In Mexico, rail reform resulted in competed vertically integrated concessionaires, which in principle have some ability to access each other's networks and offer competitive services, facilitated by trackage rights. However, in practice the trackage rights system has been difficult to implement and has not

[4] Kolik (2016)

[5] Kurosaki (2016)

achieved the hoped-for gains in competition,[6] and thus does not offer positive lessons for rail access systems in South Africa.

More success has been had in facilitating competition through access rights in the Australian rail system, and in particular the precedent offered by the Hunter Valley Access Undertaking[7] and the Interstate Access Undertaking[8] are instructive, and will be referred to here. US precedent in evaluating the costs of rail service provision also provides some insights, but is less directly relevant. The bulk of the relevant international precedent is thus EU and Australian.

2.1 Analytical frameworks for cost recovery and pricing in rail

The international literature, as well as discussions with international experts, suggest that there are three cost concepts which provide a useful framework when thinking about cost recovery in rail. The first, as has already been discussed, is marginal cost. Economic efficiency is typically enhanced when prices are set at a level sufficient to cover marginal costs, and it is also fair and reasonable to expect any beneficiary of a service to pay at least enough to cover the costs of providing that service. Marginal costs can thus be regarded as a floor below which access prices should not fall, and are also of importance when considering a Ramsey pricing scheme, as discussed in more depth in Box 1.

At the other end of the scale is the concept of stand-alone cost (SAC), which originated in the regulation of rail in the United States, and has since been used in other jurisdictions. Price regulation in US rail happens fairly infrequently, and is done only to protect captive shippers from monopolistic pricing. In those cases, prices will be constrained to the price that a hypothetical, efficient competitive entrant to the market would charge, typically to serve only the captive shipper.[9] This hypothetical entrant would need to build their own network from scratch, and then set its prices at a level sufficient to cover the cost of this new network — in other words, the stand-alone cost.[10] SAC includes both marginal and fixed costs, and is based on the current costs of constructing a network segment.[11] It should be noted that prices which are higher than is sufficient to cover SAC are not permitted in US regulation, and SAC can thus be viewed as a ceiling above which prices should not rise.

If prices are set at a level sufficient to cover SAC, then it may be possible for the operator to make quite high profits. This is particularly the case when the network investment is old enough to have already been largely or fully depreciated. In practice, however, it is unusual for rail operators to be able to raise prices to a level consistent with SAC, because intermodal competition from other freight types often constrains pricing.

The third cost recovery concept which is of importance then is the 'goldilocks' level, where prices are set at a level sufficient to allow the network to make a normal level of profit, and result in investment incentives sufficient to keep the network sustainable. Depending on the level of

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[6] Perkins (2016)

[7] Hunter Valley Coal Network Access Undertaking (2011).

[8] ARTC Interstate Access Undertaking (2008)

[9] Wilson and Wolak (2016).

[10] Baumol and Willig (1998).

[11] The World Bank railway reform toolkit talks about fully allocated costs (FAC) rather than SAC, which is a similar but not perfectly analogous concept. FAC includes an allocated share of shared and overhead costs as well; see World Bank (2017: 39).

competition from other modes of freight, it is not always possible to set prices at this level, and as a result some degree of rail network subsidization is frequently undertaken. However, even where subsidies are provided, it is important to have an estimate of this cost level in order to determine what the minimum efficient level of subsidization is.

Box 1: Ramsey pricing

Ramsey pricing systems allow cost recovery in high fixed cost industries such as rail through the use of price differentiation. Prices are set in inverse proportion to customer demand elasticity, so captive customers with low price elasticities receive high prices, and vice versa for customers with high price elasticities. All customers pay prices that at least cover their marginal costs, but they don't all pay prices which cover an equal proportion of fixed costs.

This price differentiation allows the infrastructure manager to maximise the volume of freight carried, because pri can be set low enough to make rail attractive to customers who would otherwise use other modes of transport. W these customers do not cover a 'fair' share of fixed costs, they nevertheless do cover some fixed costs, and thus help spread the burden of fixed costs among a wider customer base. Ideally, a Ramsey pricing scheme should also inclu price ceiling which will protect price inelastic customers from excessively high prices. If market circumstances conducive, the price structure can then be set so that overall revenue is sufficient to cover the total costs of serv provision.

Pure Ramsey pricing is a data intensive and complicated exercise, as the process of calculating price elasticities is technically complex. From an access pricing point of view, the process will also be complicated by the fact that a single train can carry multiple types of freight, with multiple price elasticities. However, prior to carrying out elasticity estimation exercises, it is possible to somewhat improve system volumes by introducing price differentiation based on the expert advice of sales people on customer price sensitivity. As long as care is taken not to overshoot the floor and ceiling price boundaries, this kind of Ramsey type pricing should improve rail system efficiency and sustainability, and a strong argument can be made that it should thus be tolerated by competition authorities. There is moreover substantial evidence that Ramsey-type pricing is used widely in international rail systems, including those of Germany[12] and Australia.[13]

2.2 Cost threshold 1: marginal costs

The accurate measurement of marginal costs in rail can be extremely challenging. Each train run incurs costs in terms of staffing and traction energy which are fairly easily measured, but also costs which are much more challenging to assess, such as physical wear and tear on the track, which both increases maintenance costs, and reduces the amount of time between major investments in renewal of the track infrastructure. In addition, if a single train carries freight for more than one customer, then a method needs to be found of allocating the marginal costs incurred between those customers.

In practice, the measurement of marginal cost needs to balance the goal of achieving efficient, cost-reflective tariffs with the practical ability of the operator and regulator to accurately and timeously measure such costs. While the price regulation models used internationally have become increasingly sophisticated in their cost measurement systems over time, all models still include a degree of guesswork and estimation.

In the European Community, article 31.3 of directive 2012/34/EU requires that 'the charges for the minimum access package and for access to infrastructure connecting service facilities shall be

[12] Link (2018: 18).

[13] Discussion with sector stakeholder.

set at the cost that is directly incurred as a result of operating the train service' — in other words, at marginal cost. While allowances are made for setting prices high enough to cover the fixed costs of infrastructure, as required for financial sustainability, the objective is thus to try and limit rail access charges to a level sufficient to only cover marginal costs.

European Commission Regulation 2015/909 of June 2015 then provides a more standardized definition of these directly incurred costs. This definition includes a large number of cost items which must be excluded from the direct cost calculation, as well as the following four items which may be included:

> (a) costs of staff needed for keeping open a particular stretch of line if an applicant requests to run a specific train service scheduled outside the regular opening hours of this line;
>
> (b) the part of the costs of points infrastructure, including switches and crossings, that is exposed to wear and tear by the train service;
>
> (c) the part of the costs of renewing and maintaining the overhead wire or the electrified third rail or both and the supporting overhead line equipment directly incurred as a result of operating the train service;
>
> (d) the costs of staff needed for preparing the allocation of train paths and the timetable to the extent that they are directly incurred as a result of operating the train service.[14]

As can be seen, these allowable costs include both items which vary directly with the cost of producing each unit of production, such as wear and tear on infrastructure, and some overhead costs such as train planning that are less likely to vary by train, and more closely resemble overhead costs. Not all overhead items are however eligible for inclusion, and 'network-wide overhead costs, including overhead salaries and pensions'[15] are explicitly excluded. These cost items are set with reference to the minimum access package which rail infrastructure providers in the EU are required to offer. As this minimum access package does not include traction energy, for example, this is not explicitly included in the marginal cost calculation.

European Commission Regulation 2015/909 then further advises that these costs should be calculated on a network-wide basis, attributed 'by the total number of vehicle kilometres, train kilometres or gross tonne kilometres forecasted for or actually operated'.[16] If such costs vary across different segments of the network, such cost segmentation can be imposed; and the charges levied on specific train operators can be modulated depending on factors which influence direct costs, such as train length, mass and speed. Direct costs can be calculated using either econometric or engineering cost modelling techniques.

Table 1 below provides an illustration of how DB Netz in Germany undertakes direct cost attribution. Link (2018) states that cost shares are based on expert estimates, and further points out that the key cost driver for most measures of variable costs is train weight. This is line with

[14] Article 3.4, European Commission Regulation 2015/909 of June 2015

[15] Article 4.1.d, European Commission Regulation 2015/909 of June 2015

[16] Article 5.1, European Commission Regulation 2015/909 of June 2015

econometric findings on key cost drivers in rail systems in the United Kingdom, Sweden and France.[17]

Table 1: DB Netz cost responsiveness and cost drivers of direct costs, maintenance

Measure	Cost share		Cost drivers and their share in variable costs		
	Varying with traffic volume, %	Fixed, %	Number of trains, %	Weight of trains, %	Speed, %
Clearance of faults	95	5	80	0	20
Other individual maintenance measure	80	20 (due to regular intervals)	33.3	33.3	33.3
Repair of tracks	80	20 (age, weather, track quality)	0	50	50
Repair of sleepers	50	50 (age)	0	100	0
Mud removal	15	85	20	80	0
Repair of switches	80	20 (age, weather)	0	80	20
Repair at other facilities other than tracks	80	20 (age, weather, track quality)	0	50	50

Source: Table 6 in Link (2018: 15); reproduced under the Creative Commons License CC BY 4.0.

DB Netz further uses book depreciation of the track infrastructure (in other words, linear depreciation over the legal life span of the asset) as a proxy for the cost of track renewals. Link (2018) argues that this may provide a proxy for average renewals costs, but is problematic to the extent that it does not take into account 'differences in wear and tear due to intensity of usage and load' across different access users. Link speculates that the use of this approach is likely due to the absence of sufficient data to undertake a more rigorous cost analysis.[18]

In Australia, the Australian Rail Track Corporation (ARTC) provides access to its network through a number of access undertakings concluded with the Australian Competition and Consumer Commission (ACCC). In these undertakings, the infrastructure provider is allowed to vary access prices between a floor contribution and a ceiling limit for different access seekers, with these terms defined as follows:

> The 'Floor Contribution' for an Access Holder in respect of a Train Path is… an amount equal to the Variable Maintenance Cost … imposed by that Access Holder…
>
> 'Ceiling Limit' means the Economic Cost of those Segments …. which are required for the provision of any Train Path or group of Train Paths operated on behalf of a relevant Access Holder or group of Access Holders.[19]

[17] Link (2018: 16).

[18] Link (2018: 16)

[19] Hunter Valley Coal Network Access Undertaking (2011: 31).

The floor contribution concept is similar to the definition of marginal cost set in European Commission Regulation 2015/909 of June 2015. In the Australian Interstate Access Undertaking, the following definition of the floor limit price is provided:

> The Floor Limit means revenue for ARTC sufficient to cover the incremental cost of that Segment or group of Segments. For the purpose of this clause, incremental costs means the costs that could have been avoided if a Segment was removed from the Network including Segment Specific Costs and Non-Segment Specific Costs relating to the following activities:
>
> (i) track and signalling and communication maintenance;
>
> (ii) maintenance contract support, administration and management and project management;
>
> (iii) train control and communication;
>
> (iv) train planning and operations administration; and
>
> (v) system management and administration;
>
> but excluding Depreciation and return on assets relating to Segment Specific Assets and Non-Segment Specific Assets, such return being determined by applying a real Rate of Return to the value of these assets.[20]

The access undertaking allows the variable maintenance cost elements of the floor contribution to be determined either by engineering assessments, or by other methods, with regards 'to the purpose, causal factors and cost drivers for the project.'[21] The ceiling limit on the access price in the HVAU allows the infrastructure provider to cover capital costs, and will be discussed in the next section on the treatment of fixed costs.

Operating costs are also defined in US regulation, but again in a very different regulatory context. The Surface Transportation Board (STB) regulates US rail, but only intervenes in rate determination in a very limited number of cases, and then they regulate the shipping prices the railway operators offer to freight owners, rather than the cost of access to the network for competing operators. The definition of rail variable cost used by the STB thus includes costs such as locomotive repairs and crew wages. Wilson & Wolak (2016) detail the fifteen activities included in the STBs' Uniform Rail Costing System (URCS).

The URCS is based on a massive data set collected annually from US railways, and compiled by the STB. The formula the URCS uses to calculate variable cost is:

$$VC(q) = R(q;1)C(q;1) + R(q;2)C(q;2) + \ldots + R(q;K)C(q;K)$$ [22]

In this formula, VC is total variable cost, q is the shipment commodity type and quantity, and K is the accounting cost category. C(q;K) is thus the total cost of a given shipping category for a given shipment commodity and quantity. Each activity cost is then weighted by R(q;K), which is

[20] ARTC Interstate Access Undertaking (2008: clause 4.4b)

[21] Hunter Valley Coal Network Access Undertaking (2011: 35).

[22] Wilson and Wolak (2016: equation 1).

weight given to that cost for that shipping commodity and quantity. R is determined by the STB using econometric methods. The net impact of this methodology is to produce cost estimates which more closely resemble average variable costs rather than true marginal costs (Wilson and Wolak (2016) describe it as an 'accounting cost allocation procedure').

Viewed as a whole, a number of observations can be made as regards international practice in the measurement of rail marginal costs. Firstly, the line items which are included in the definition of marginal costs are to some extent dependent on how access is conceptualized, and the purposes of the access pricing regime. Thus in the US, where freight rates are under consideration, staff wages are a relevant operating cost line item; whereas in the EU and Australia, access is provided to a train operator which supplies their own staff. A meaningful discussion on the definition of marginal cost in South Africa thus will need to be grounded in a shared understanding of what the access package will include.

Secondly, it is typical to take into account the factors which affect marginal costs before allocating costs between trains. These types of factors include train characteristics (eg weight and speed), network characteristics (high speed passenger track networks typically are in a separate cost category), and to some extent freight type (in the US this is explicit, while in the EU an emphasis on the promotion of fair competition between operators may implicitly result in some standardization of access rates by freight type). Once cost allocation factors have been put in place, the manner in which operating costs are allocated to different activities typically seems to produce a cost estimate which more closely resembles the average variable cost than marginal cost.

Finally, there seems to be tolerance of the use of a variety of measurement methods to estimate and allocate variable costs. Both bottom-up estimates based on engineering observations and top-down econometric techniques of cost allocation are used. There thus seem to be an implicit acceptance that the task of allocating costs in rail is sufficiently technically complex that perfectly accurate estimates are not possible, and thus that methods which can consistently, transparently produce justifiable cost estimates are acceptable for regulatory purposes — although more technically rigorous estimation techniques are typically implemented over time.

2.3 Cost thresholds 2 and 3: treatment of fixed costs

The costs of rail infrastructure need to be covered in some way, and if the state cannot afford to fund them, then they will need to be covered by the users of the network. The way in which such assets are valued, however, can vary substantially, with material consequences for access prices and investment incentives. It can be useful to think of the choice of asset valuation technique as a means of balancing the interests of consumers versus the interests of investors. In research on the appropriate valuation of assets for the Dutch gas transmission system, Oxera Consulting characterized these balancing objectives as 'fairness to consumers' requires that 'consumers do not pay again for networks whose value has already been factored into energy tariffs', and 'fairness to investors' requires that the operator should earn a fair rate of return on any investment prudently and efficiently incurred'.[23]

To illustrate how material the choice of asset valuation technique can be, Oxera then estimated how asset values varied by asset valuation technique used. The net book value of the Dutch gas transmission system provided the lowest asset value estimate, which was only around 16 per cent of the value that a recent investor had paid to acquire the system.

[23] Oxera Consulting (2011: 14)

In US regulatory precedent, the highest price level which is tolerated by the regulator is that which is consistent with the stand alone cost of building a hypothetical competing infrastructure from scratch. In the Dutch gas transmission system example above, this corresponds most closely to the depreciated replacement cost estimate.[24] A price which is set high enough to cover the acquisition value of the system, in this case, would be viewed as unacceptably high, and in essence as a case of monopolistically abusive excessive pricing.

The technique typically used to estimate the costs of a hypothetical competitive market entrant is depreciated optimized replacement cost (DORC). In summary, the goal of this technique is to estimate:

> … the depreciated cost of the most efficient combination of assets that could replace the existing network and provide the level of service required by customers. That is,… a measure of replacement costs that reflects the optimal configuration of the network, the most efficient technology, and the relevant asset prices *at the time of the assessment.*[25]

Because the DORC valuation technique relies on current construction prices and most recent technology, it will tend to produce an asset value estimate that is higher than an estimate based on actual historical investment levels. This also implies that it is possible for an operator to make accounting profits at price levels that are not high enough to recover a DORC valuation of assets. Achievement of DORC-consistent prices is thus not necessarily required to achieve network sustainability.

These concepts are directly applicable in Australian regulatory treatment of fixed costs in rail. As spelled out in the 2008 ARTC Interstate Access Undertaking, access charges need to be set in a manner which balances the legitimate business interests of the ARTC, the public interest, and the interests of access applicants.[26] To achieve this, the ARTC's access pricing system allows substantial price differentiation between different types of access seekers, based both on the extent of intermodal competition and the ability of the customer to pay.

The ceiling limit on prices in the interstate access undertaking is the price sufficient to cover the depreciated optimized replacement cost (DORC) of assets, where optimized replacement costs are defined as 'the cost of replacement by commercially efficient application of best known currently available technology based on existing capacity and performance characteristics of the asset.'[27] Access prices in the Hunter Valley system, where traffic comprises principally coal freight, and where intermodal competition from road is not constraining, are sufficient to cover the DORC cost of capital. On the rest of the ARTC network, intermodal competition constrains prices below the DORC-consistent level.[28] As has already been discussed in the previous section, the floor limit for access prices covers only avoidable costs, and thus does not help to recover the fixed cost of assets.[29]

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[24] Oxera Consulting (2011: 2)

[25] Oxera Consulting (2011: 2-3)

[26] ARTC Interstate Access Undertaking (2008: clause 4.1; 1.2(d)).

[27] ARTC Interstate Access Undertaking (2008: clause 4.4(d)(ii)).

[28] Telephonic converzation, Australian rail sector stakeholder.

[29] ARTC Interstate Access Undertaking (2008: clause 4.4(b)).

The ARTC owns and runs Australia's interstate network, but there are also rail systems which are owned and run by state governments. The ARTC receives a fairly small amount of state funding (in 2020, government grants were only 6.4 per cent of the size of income earned from access fees),[30] but lower volume branch lines owned by state governments are in some cases more heavily subsidized.

In addition to these explicit subsidies, in a number of cases exclusions have been made from the rail regulatory asset base in Australia, which will tend to reduce the revenue required to keep rail operations sustainable, and thus will tend to reduce access fees. These include the following:

> In Victoria, the regulated asset base for rail infrastructure excludes capital expenditure before 30 April 1999 (that is, before the leasing of rail infrastructure to the private sector). Assets purchased since this date are included at original cost with allowance for inflation, depreciation, subsequent disposals and any relevant capital expenditure by infrastructure providers (ESC 2006c).
>
> Similarly, while New South Wales uses DORC methodology to value assets, only coal lines are considered to have any value for the purposes of calculating the asset ceiling, meaning that 94 per cent of route kilometres within the rail network are attributed no value for regulatory purposes (IPART 1999).
>
> There are significant differences between jurisdictions in the treatment of land in regulatory asset bases. In the ARTC undertaking and the NSW regime, no allowance is made for land, while in South Australia land and foundation works are valued at historical cost (unless leased from the government at nominal rent, in which case they are excluded) (ESCOSA 2004). The Queensland Competition Authority (QCA), however, includes land in the regulatory asset base and values it using DORC methodology (QCA 2001).
>
> Assets contributed by governments typically are excluded from regulatory asset bases. The new Victorian access regime contains a pass-through mechanism which requires infrastructure providers to reduce their cost base by the value of any government funding or investment relating to their infrastructure. The Western Australian regime recognises government funding as a revenue source and therefore deducts it from overall revenue requirements when calculating the floor and ceiling prices.[31]

In the EU, levels of subsidization of the rail network are frequently quite high, and in some cases a very small proportion of fixed asset costs are covered by access prices. The way in which fixed assets are valued is thus often not a particularly important regulatory question when determining access prices. Instead, the focus is on determining a level of subsidization which is sufficient to keep the entity financial sustainable on a year-to-year basis.

European Commission regulations instruct that, for the purposes of calculating direct costs, assets should be valued at the lower of current or historical costs.[32] Where it is necessary to set charges

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[30] ARTC financial statement 2019/20, https://www.artc.com.au/uploads/ARTC-Financial-Statements_2019-20-final-version.pdf

[31] Australian Productivity Commission (2006: 138).

[32] Article 3.3, European Commission Regulation 2015/909.

higher than direct costs in order to improve cost recovery rates, the European Commission provides more leeway to consider asset pricing methodologies other than historical cost, and states that:

> For specific future investment projects, or specific investment projects that have been completed after 1988, the infrastructure manager may set or continue to set higher charges on the basis of the long-term costs of such projects if they increase efficiency or cost-effectiveness or both and could not otherwise be or have been undertaken. Such a charging arrangement may also incorporate agreements on the sharing of the risk associated with new investments.[33]

A 2015 review of rail charging practices in 19 European countries found that only Croatia, Germany and the United Kingdom determine a regulatory asset base (RAB) for rate determination purposes, and that the manner in which assets are valued varies across countries. While historic asset values are used in Austria, Croatia and Finland, the Netherlands uses an estimate of future maintenance and renewal costs, and Germany is reported to use historic values updated for material changes in current costs.[34] German asset values may however still be affected by a massive devaluation of the rail asset base undertaken during reforms in the 1990s. The value of track and rolling stock was reduced by 75 per cent, and over1994–2003, the construction of new track to the value of €180 billion was subsidized by the state.[35]

The asset valuation approach used in the UK is fairly different, with the rail regulator describing the method used to determine RAB values as depreciated replacement cost.[36] While replacement costs are typically higher than historical costs, the way in which fixed costs are covered in British rail means that these higher asset valuations do not feed into higher access fees, which instead are set at a level sufficient only to cover marginal costs. Fixed costs in British rail are instead covered by fixed charges placed only on passenger franchises. As these franchises are subsidized by the state, Nash and Smith (2020) argue that in effect the fixed cost of British rail is financed by the state, via the effects it has on the size of the passenger subsidy needed.

The UK was also the only regulatory regime found which has used a price cap methodology in rail, but this approach has moderated substantially over time, and while the current approach continues to monitor efficiency levels, it now more closely resembles a required revenue methodology (see Box 2 below for a discussion of price regulation methodologies). The fixed track access charges paid by passenger franchises are calculated using a method which 'allocates the RAB return to asset categories on the basis of the proportion of long-run renewals expenditure.'[37]

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[33] Article 32.3, Directive 2012/34/EU.

[34] IRG-Rail (2015: 22).

[35] Fularz (2012: 49).

[36] Office of Rail and Road (2018: 15).

[37] Office of Rail and Road (2018: 15).

Box 2: Price regulation methodologies

Two main types of prices regulation methodologies are available to regulators.[38] The first can be variously described as a rate of return or cost plus regulation system, and in the South African ports system is often referred to as a required revenue method. In this system, the regulated entity is guaranteed that tariffs will be set high enough to recover costs incurred, plus a margin sufficient to fairly reward investors. The main alternative to this type of price regulation is price cap regulation, where the regulator determines the price level, and then allows the regulated entity to keep any profit it generates in the price regulation period by improving its cost efficiency.

Rate of return regulation requires the regulator to have extensive data on the costs of the operator, and monitor achieved levels of profitability. It can thus be quite resource-intensive to implement. It also does not strongly incentivise the operator to be efficient, as regulation provides it with a guarantee that revenue will be sufficient to cover costs. Price cap regulation in theory addresses both these problems. The regulator no longer needs to closely monitor profitability levels, or have a detailed understanding of costs, they merely need to be able to predict how much the operator can be expected to increase efficiency levels by. The price cap mechanism then gives the operator a strong incentive to be as efficient as possible, as all cost savings in the current regulatory period can be retained as profit (in the following period, prices are lowered to return the benefit of improved efficiency to customers).

In practice, the distinction between these two mechanisms is often much less clear. Regulators in rate of return systems often monitor performance to try and improve efficiency (or at least prevent the unnecessary gold-plating of asset values), or include efficiency incentives in the regulatory scheme. This has been the case in the South African ports system, where the Ports Regulator has introduced efficiency incentives.

Conversely, in price cap systems it can be quite data intensive to determine what efficiency factor is appropriate. If the efficiency factor is set at a level such that the operator makes losses, it can quickly become politically desirable to review the operator's accounts and try and set prices at a level which ensure a fair return on assets, in a manner which begins to approach the method used in rate of return systems.

Price cap systems are also often easier to use in industries where the rate of technological change is very rapid, and thus ongoing cost efficiency improvements are more likely to happen. There is thus arguably a stronger rationale for using price cap methods in sectors such as telecommunications rather than in the rail sector, where the technologies are more established. A review of international practice suggests that rate of return methods of price regulation are more widely used in rail. The exception is the United Kingdom, but converzations with sector experts suggests that the use of price cap regulation in the English rail system has been moderated as time has passed.

The time value of money is regarded as a recoverable cost in a number of EU countries. In France, the complete cost of infrastructure incurred by the infrastructure manager (IM) is regarded as including 'all the charges borne by the IM related to construction, operation, maintenance and renewal of the infrastructure, including the amortization of investments and the remuneration of the capital invested by the IM.'[39] In Germany, capital costs are also considered to be eligible for cost recovery, and are estimated using a weighted average cost of capital (WACC) measure. The use of WACC has however been controversial, given that the infrastructure operator remains 100 per cent state owned, and that about two-thirds of infrastructure operator revenues are derived from state agencies.[40]

[38] Gumede and Chasomeris (2017: 615).

[39] IRG-Rail (2015: 21).

[40] Link (2018: 11).

South African asset valuation precedent in transport: airports, pipelines, ports

While economic regulation of rail in South Africa has yet to be implemented, economic regulation of three different transport modes is in place, namely airports, pipelines and ports. In the ports and pipelines sectors, moreover, the principle regulated entity is Transnet, which is also the vertically integrated state-owned rail operator. The regulatory framework in these sectors thus provides some insight into the manner in which asset valuation processes, and particularly those involving state-owned enterprises, have previously played out.

Airports

Airport tariffs are at present set by the aviation Regulating Committee (which the Economic Regulation of Transnet Bill will roll into the envisaged multisectoral Transport Economic Regulator). The framework for the tariff is a price cap approach, and the methodology used for valuing the regulatory asset base is based on the opportunity cost of assets.[41] As the opportunity cost value of highly specialized assets may be zero, the methodology then suggests that specialized assets 'should be included in the RAB at historic cost and depreciated accordingly in order to preserve the incentive to reinvest.'[42] Assets valued in this way include runways and other specialized assets.

An opportunity cost valuation however is regarded as appropriate for non-specialized assets, which do have alternative uses. Given the potential complexities of determining the next best use of each asset, opportunity cost is then approximated by an estimation of the depreciated replacement cost of the asset. Assets valued in this way include land, buildings and other non-specialized assets (mostly vehicles and equipment).

Only assets which are used and usable are eligible for inclusion in the RAB, and assets which are not part of the core business (the example given is a portfolio of shares), must be ring-fenced from the RAB. Forecast capital expenditure can also be included in the RAB in certain circumstances.

Pipelines

The piped gas and petroleum transmission and storage systems are regulated by the National Energy Regulator of South Africa (NERSA), under two distinct regulatory regimes. While there are a number of firms active in both sectors, Transnet's pipelines division owns a significant proportion of national pipeline infrastructure.

The guidelines for RAB valuation issued by NERSA allow it to exclude assets which are neither used nor useful, as well as to undertake prudency assessments of new investments, to ascertain whether such investments comprise unnecessary over-investment. The asset valuation methodology for piped gas is described as 'The value of the regulatory asset base is the inflation-adjusted historical cost or trended original cost (TOC) of plant, property and equipment less the accumulated depreciation at the commencement of the period under consideration plus the net working capital'.[43]

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[41] Regulating Committee to ACSA and ATNS (2009: 32, 16).

[42] Regulating Committee to ACSA and ATNS (2009: 17).

[43] National Energy Regulator of South Africa (2017: 24).

The valuation formula includes an allowance for funds used during construction of a piped gas facility. The maximum allowance per period is calculated at the beginning of construction, and includes the cost of borrowings and a reasonable return on equity. This contrasts to the RAB calculation method used for petroleum pipelines, which is largely similar except that no allowance for funds used during construction can be included in the RAB.[44]

Where historical costs are not available, the regulator can use an estimate of historical costs to enter assets into the RAB. The need for this method is described as follows:

> Use of historical costs requires information dating back to when the oldest assets in service were first commissioned. For long-lived pipeline assets, this may be some time ago, and the relevant information may not be readily available. In the same vein, some electricity lines businesses' asset registers may be incomplete or/and incorporate inconsistent assumptions about depreciation. To address these limitations, the Energy Regulator may make specific decisions in this regard to determine a vesting RAB of the assets in question. This is expected to be a once-off valuation at the start of economic regulation. A form of modified historical cost valuation approach or trended original cost, taking into account the estimated remaining useful life, will be applied to determine the vesting RAB of the affected long-lived assets. The so determined vesting RABs become the proxy for historical cost going forward.[45]

For petroleum pipelines, the methodology used is a rate of return method,[46] with assets also valued on a trended original cost basis. This valuation method 'is preferred for its ability to encourage efficient tariffs, affordability of service, and access to the industry.'[47] Regulation of petroleum pipelines has been affected by the cost over-runs on the construction of the New Multi-Product Pipeline by Transnet. At inception in 2007, the projected cost of this project was R11,137 million, to be completed by 2010. As at 2019 Transnet expected the project to be completed in 2023, and projected costs had ballooned to R29,322 million (no forecast of total costs to 2023 was provided).[48] Given Transnet's 'inaccuracy in forecasting both the cost and timing (ability to operate dates),'[49] in 2016/17 NERSA decided to place a hold on the assets allowed in to the regulatory asset base at the then value of R26,211 million, and anticipated that 'the value of the MPP assets will still be subjected to further prudency assessments and verification.' These kinds of issues as regards the regulatory asset base may be of relevance in the rail sector going forward, as a number of allegations of imprudent and in fact in some cases fraudulent expenditure have been made against Transnet Freight Rail in recent years.[50]

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[44] National Energy Regulator of South Africa (2020(b): 10).

[45] Department of Energy (2016: 13).

[46] National Energy Regulator of South Africa (2020(b): 9).

[47] National Energy Regulator of South Africa (2020(a): 16).

[48] National Energy Regulator of South Africa (2020(c): 7).

[49] National Energy Regulator of South Africa (2020(c): 7).

[50] Khumalo, S. 17 November 2018. *Report recommends legal action against Transnet executives over locomotives deal*. News24. https://www.news24.com/fin24/companies/industrial/report-recommends-legal-action-against-transnet-executives-over-locomotives-deal-20181117

Ports

The South African ports landlord is owned by Transnet, which also supplies terminal operator services. The tariffs levied by the port's landlord, the National Ports Authority (NPA), are regulated by the Ports Regulator of South Africa (PRSA), which was established by the National Ports Act 2005. The policy framework of the PRSA directs it to set tariffs so as to allow the NPA to:

- recover its investment in owning, managing, controlling and administering ports and its investment in port services and facilities;
- recover its costs in maintaining, operating, managing, controlling and administering ports and its costs in providing port services and facilities;
- make a profit commensurate with the risk of owning, managing, controlling and administering ports and of providing port services and facilities.[51]

The regulatory framework thus is designed to allow for full cost recovery. The South African maritime ports system has historically been the most profitable division of Transnet, and in fact there have been formal complaints of excessive pricing in the ports system taken to the Competition Commission (no outcome has yet been forthcoming). The ports system is thus well placed to be self-sustaining, and there is little risk of the sector requiring government subsidization.

The tariff setting approach used by the PRSA is a rate of return method, with required revenue calculated as follows:

$$
\begin{aligned}
&\textit{Revenue Requirement} \\
&\quad = \textit{Regulatory Asset Base } (RAB) \\
&\quad \times \textit{Weighted Average Cost of Capital } (WACC) + \textit{Operating Costs} \\
&\quad + \textit{Depreciation} + \textit{Taxation Expense} \pm \textit{Clawback} \\
&\quad \pm \textit{Excessive Tariff Increase Margin Credit } (ETIMC) \\
&\quad \pm \textit{Weighted Efficiency Gains from Operations } (WEGO)
\end{aligned}
\quad [52]
$$

The WEGO mechanism incorporates an efficiency incentive into the rate of return methodology, and the clawback factor allows the regulator to take into account the effect of forecast inaccuracy. The excessive tariff increase margin credit (ETIMC) mechanism 'allows for large increases in required revenue and/or tariffs that may arise from volume volatility or substantial capital expenditure programmes in future years to be partly offset by moderately higher tariff increases in the short-term.'[53]

The regulatory asset base valuation methodology was finalized in 2018, after the release of a discussion document from the regulator which sets out its thinking on the relative merits of various asset valuation techniques. Substantial attention is paid to the implications of using DORC, which

[51] Ports Regulator of South Africa (2020(b): 4).

[52] Ports Regulator of South Africa (2020(a): 7).

[53] Ports Regulator of South Africa (2020(a): 7).

is described as 'emulating a contestable market by setting tariffs at a level required to leave a new entrant neutral with respect to the option of entering the market.'[54] The regulator notes that:

> … port infrastructure in South Africa is state-owned through an Authority and the National Ports Act prevents private sector ownership of ports and port assets. There is thus no real need to 'leave a new entrant neutral to entry into the market' such as the objective in using DORC in some network industries in Australia and elsewhere.[55]

The discussion document does not identify the potential use of DORC as a means of calculating ceiling prices and thus preventing excessive pricing.

The asset valuation methodology chosen in ports is that of financial capital maintenance (FCM) based on trended original cost (TOC). In addition, the assumption is made that all assets capitalized before 1990 have already been fully or largely depreciated, and are thus included in the regulatory asset base at historical cost/depreciated original cost.[56] The 1990 baseline was chosen because that was the year that Transnet undertook to create an electronic balance sheet for the first time. The take-on value of assets in this exercise was book value net of depreciation, and in some cases, where documentation was not available, may have been an estimate of book value.[57]

Lessons from asset valuation precedent

From the precedent discussed above, it is clear that there is no single 'right' way to value the assets of a regulated firm. The context of the firm itself, and the sector in which it is located, must be taken into consideration. In addition, non-financial policy objectives may provide incentives to reduce asset values — although when this is done, the state should ideally do so with an explicit understanding that government funding may then be needed to keep the sector sustainable.

In the rail sector, the clearest lesson which emerges from this international precedent is that it is quite rare for rail to have sufficient pricing power to set access fees high enough to cover the DORC valuation of fixed assets. Instead, it is much more common to see active attempts made to reduce access fees to improve competitiveness with road freight and facilitate greater rail traffic, either via state funding for network assets or operational expenditures, or via the exclusion of some proportion of assets from the regulatory asset base. Where rail freight systems do make profits and are sustainable, as seen for example in large parts of the ARTC network and in much of the (vertically integrated) United States rail network, the profits made are typically made on a historical asset valuation rather than a DORC basis.

Regulation of parts of the transport network in South Africa uses a wide range of asset valuation techniques. However, historical asset valuation techniques are somewhat more common, as are required revenue approaches to price setting. In ports in particular, asset base adjustments have been undertaken to ensure that the risk to consumers of paying again for assets which have already been depreciated is reduced.

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[54] Ports Regulator of South Africa (2018(a): 8).

[55] Ports Regulator of South Africa (2018(a): 9).

[56] Ports Regulator of South Africa (2018(b)).

[57] Personal discussions with sector stakeholder.

3 International practice in rail access price design

Once agreement has been reached on which costs should be covered in the rail access price, the next problem which needs to be resolved is how to set the tariff strategy in order to distribute those costs between different users. Because a high proportion of costs in rail are shared fixed costs, this is a more complex issue than in sectors with a smaller share of fixed costs. The way in which pricing structures are set can also have a deep impact on sector outcomes, not least because of the behavioural incentives prices set for access seekers, and the knock-on effects this may have on the achievement of policy objectives.

The administrative complexity of the pricing system is also of consideration. A pricing system which perfectly apportions costs and sets incentives but is too complex to use does not add value. As summarized by Link (2018):

> Given that track users have an interest in not too complex charges, a feasible compromise is needed between the desirable level of differentiation to reflect cost cauzation and a sufficient degree of simplicity and transparency of the charging scheme.[58]

3.1 Price differentiation

As discussed in Box 1, price differentiation in rail can be a useful tool for improving network volumes. Given the high fixed costs of the rail network, moving larger volumes allows fixed costs to be spread more widely, in a way that potentially improves system outcomes for all customers. This kind of price differentiation thus should be regarded as pro-competitive and efficiency maximizing in effect. Before exploring how such pro-competitive price differentiation can be undertaken, however, it is useful to explore its limits, by examining what constitutes anti-competitive price discrimination.

The most straightforward pro-competitive defense of price discrimination is when it reflects actual differences in the cost of production and supply. In South African competition law, price differentiation which 'makes only reasonable allowance for differences in cost or likely cost of manufacture, distribution, sale, promotion or delivery resulting from the differing places to which, methods by which, or quantities in which, goods or services are supplied to different purchasers'[59] is explicitly not prohibited.

In the context of rail access, this implies that access prices that differ according to cost factors such as the weight of a train, which affects the amount of wear and tear on the track, or the speed of a train, which can also affect congestion and thus increase the per-train cost of accessing the network, are legitimate. This is in line with international precedent, as discussed in section 2.2.

Section 9(2)(b) of the Competition Act 1998 then further permits price differentiation where it 'is constituted by doing acts in good faith to meet a price or benefit offered by a competitor.' In rail, the main form of competition for many freight customers is intermodal competition from road. This implies that it would be consistent with competition law for rail access prices to be lower in parts of the network where competition from road is more vigorous.

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[58] Link (2018: 26).

[59] Competition Act no 89 of 1998, s9(2)(a).

The last type of price differentiation explicitly condoned in the Competition Act 'is in response to changing conditions affecting the market for the goods or services concerned,'[60] and here the concern is with deterioration of perishable goods or imminent obsolescence. From the rail access perspective, this could be applicable in a situation where a slot was going empty (in other words, on the brink of obsolescence), and a last-minute discount was offered to a new access seeker.

In contrast, prohibited price discrimination has two key components in South African law, as follows:

> S9(1)(a) it is likely to have the effect of substantially preventing or lessening competition;
>
> (b) it relates to the sale, in equivalent transactions, of goods or services of like grade and quality to different purchasers.[61]

Price discrimination then occurs both if the price offered to different customers differs, or if there are discriminatory differences in terms of discounts, rebates, service levels, payment terms, and so forth. An example of this second kind of price discrimination occurred in the German rail system. In the 1990s, DB AG offered access discounts that could only be achieved at volumes above 14 million train kilometers per annum in freight and long-distance passenger rail, and 0.3 million train kilometers per annum in short distance passenger rail. In a system where DB was the largest operator by a long margin, this system ensured that DB achieved consistently higher discounts than any of its competitors — in short distance passenger rail, for example, DB achieved 13 per cent access discounts while the largest discount achieved by a competitor was 4 per cent.[62] This was viewed as discriminatory, and would certainly have improved the ability of DB to offer lower prices to freight owners than its competitors could — thus meeting the requirement for a finding of price discrimination in South African competition law, of prevention or lessening of competition.

From the point of view of transport policy, a key concern in access price differentiation is this issue of prevention or lessening of competition, specifically in the market to provide logistics services to the owners of freight. Allowing third-party access on to the South African rail network has great potential to increase system volumes, and improve the quality of service, but only if access seekers are able to effectively compete with the incumbent.

In Australia, price differentiation in rail access is allowed, but subject to a number of limits. The price floor and ceiling are set in the access undertaking, and ARTC must ensure that similar applicants are treated similarly in terms of the prices they are offered. These similarities relate to factors which affect the cost of access, the service characteristics of access, and the freight markets in which access seekers operate, as follows:

> ARTC will not differentiate between Applicants in circumstances where:

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[60] Competition Act no. 89 of 1998, s9(2)(c).

[61] Competition Act no. 89 of 1998, s9(1).

[62] Link (1997: 4, 5). It is likely that this discount structure historically offered by DB would now be inconsistent with EU Directive 2012/34/EU, article 33, which recommends that discounts should in general be limited to the administrative savings actually achieved by the infrastructure manager. Exceptions to this rule are then only justified 'to encourage the development of new rail services, or discounts encouraging the use of considerably underutilised lines,' and must be offered to all infrastructure users.

(i) the characteristics of the Services are alike; and

(ii) the Applicants are operating within the same end market.

For the purposes of this clause, ARTC will determine whether the characteristics of two Services are alike having regard to matters including but without limitation location, duration and quality of the Train Path, nature of Train consist, characteristics of the Service, longevity of Access, arrival and departure times of the day and week.[63]

The net effect of these provisions is to ensure that competition between access seekers for the business of freight owners is not distorted by the access regime. Competition in the freight end market is thus preserved.

EU Directive 2012/34/EU includes a number of provisions which pertain directly to the manner in which rail access prices should be differentiated, which are worth going over in some detail. The first is as follows:

> Except where specific arrangements are made under Article 32(3), infrastructure managers shall ensure that the charging scheme in use is based on the same principles over the whole of their network. [64]

The article 32(3) exceptions are designed to address the funding needs of specific investment projects, as follows:

> For specific future investment projects, or specific investment projects that have been completed after 1988, the infrastructure manager may set or continue to set higher charges on the basis of the long-term costs of such projects if they increase efficiency or cost-effectiveness or both and could not otherwise be or have been undertaken. Such a charging arrangement may also incorporate agreements on the sharing of the risk associated with new investments.

In practice, the volume carried on different segments of the rail network will tend to vary widely. If prices are set with reference to the average cost per network segment, this would imply that access costs would also vary widely, with access fees in less densely trafficked areas of the network being higher than those in more dense areas of the network.

This would have a number of undesirable consequences. It would incentivize traffic to be redirected to more congested areas of the network, in order to realise lower access fees. Once the denser areas of the network were operating at full capacity, it would allow operators who had slots on the dense network segments to operate at a sustained and arguably unfair competitive advantage to their competitors with slots in the less dense parts of the network. Access fees would probably need to be adjusted frequently and unpredictably, and would potentially swing wildly during those adjustments, due to changes in network volumes. Network segments which lost a substantial proportion of traffic could quickly enter a 'death spiral,' with rising access fees pushing all remaining traffic off the line. It would also make it extremely difficult to open new network segments, as the access fees during the initiation phase when customers were being courted would be at their highest, thus discouraging a switch from road to rail freight. These are presumably some of the reasons why the EU recommends that charging be uniform over the network as a whole.

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[63] ARTC Interstate Access Undertaking (2008: 21)

[64] Article 29.2, Directive 2012/34/EU.

Nevertheless, discussions with potential concessionaires of Transnet branch lines suggest that volume-based pricing per network segment is the access pricing strategy that is currently being offered by the incumbent.

The second component of the 2012 EU directive which pertains to access pricing differentiation is as follows:

> Infrastructure managers shall ensure that the application of the charging scheme results in equivalent and non-discriminatory charges for different railway undertakings that perform services of an equivalent nature in a similar part of the market and that the charges actually applied comply with the rules laid down in the network statement.[65]

The directive thus does not require that price differentiation be strictly based on differences in the cost of service provision, which allows for Ramsey-type price differentiation, and also for access prices that penalize noise pollution, for example, or try to incentivize good timekeeping practices. Instead, the focus is on ensuring that there is no discrimination between rail undertakings which are offering similar services. In effect, this is quite similar to the emphasis in South African legislation on preventing price discrimination that prevents or lessens competition, as it seeks to ensure that competing firms are placed on a level playing field.

The emphasis on rule-based pricing is also of note. The type of transparent pricing rules envisaged by the EU introduce fairness and predictability into the pricing of rail access, and allow access seekers to plan train paths to minimize access costs. A transparent rule-based system can also be thoroughly vetted by regulators and competition authorities before implementation.

The third and final part of Directive 2012/34/EU which merits discussion at this point is article 32, which discusses how mark-ups to marginal cost should be distributed between access seekers. The recommended approach is to divide the market into segments, evaluate the ability of customers in each segment to bear the cost of mark-ups, and then make the decision on how to distribute mark-ups between segments. The following recommendation on how to segment the market is made:

> The list of market segments defined by infrastructure managers shall contain at least the three following segments: freight services, passenger services within the framework of a public service contract and other passenger services.
>
> Infrastructure managers may further distinguish market segments according to commodity or passengers transported.

Annex 1 sets out the manner in which prices are differentiated in the German rail system, which includes segmentation on the basis of train speed and frequency, as well as train weight and other characteristics.

Segmentation that distinguishes between passenger and freight is probably justifiable on a cost basis alone, given the very different scheduling, speed, and train weight characteristics of passenger as compared to freight. Segmentation by commodity or passengers transported, however, also allows for the possibility of segmentation by factors such as ability to pay, or extent of intermodal competition. From the point of view of access pricing, a single train can carry multiple types of

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[65] Article 29.3, Directive 2012/34/EU.

cargo, and thus it might be practically quite difficult to vary access prices by commodity type. However, it is possible that on certain routes, for example on mine to port export lines where specialized trains carry a single bulk commodity, it might be administratively feasible to offer access prices that distinguish on the basis of commodity carried.

3.2 Minimum access package, ancillary facilities and services

Before access pricing terms can be meaningfully set, some agreement needs to be reached about what the access package will include. The parameters which need to be agreed on are how services will be structured, and what the access seeker will have an access right to. In addition, it is useful to be able to set prices with reference to a baseline train with representative technical characteristics of service, and then have modification rules which determine how prices will change as train characteristics change.

In the EU, the minimum access package must include the following:

> (a) handling of requests for railway infrastructure capacity;
>
> (b) the right to utilise capacity which is granted;
>
> (c) use of the railway infrastructure, including track points and junctions;
>
> (d) train control including signalling, regulation, dispatching and the communication and provision of information on train movement;
>
> (e) use of electrical supply equipment for traction current, where available;
>
> (f) all other information required to implement or operate the service for which capacity has been granted.[66]

Access must then also be provided to a wide range of additional facilities, including rail facilities in ports, marshalling yards, storage sidings, all the way down to train cleaning facilities, and additional charges can be levied for these services.[67] Nash (2005) suggests 'that typically these charges are based on average rather than marginal cost and, although in most cases they do not appear to be a large part of the total charge, it is possible that they both distort traffic levels and discourage entry, particularly where the charge is for use of a facility that the incumbent operator provides.' Nevertheless, across much of the EU separate charges are in fact levied for use of such facilities.

Hylén (2001) describes the manner in which access to various ancillary services are provided across the EU as displaying 'an astonishing range of organizational peculiarities.' The results of a survey of six EU countries' charging practices for such facilities is shown in Table 2 below. To take the example of freight terminals, while in Denmark access to such terminals is provided free of charge, and in the UK some terminal prices are regulated, in other markets rates are determined simply by commercial agreement.

[66] Annex II , Directive 2012/34/EU.

[67] Nash (2005: 267).

Table 2: Charging practices for service facilities

	Sweden	**Denmark**	**Germany**	**Netherlands**	**UK**	**France**
Electrical supply - hardware	none	none	Included in access charges	none	For use of transformers, etc	-
Electrical supply - power	Market rates	Infrastructure manager tariff	Infrastructure manager tariff	Market rates	Cost price estimated per gross ton-km	Yes
Refuelling facilities	Market rates	DSB (operator) or other supplier	DB or non-federal railways	Market rates	Cost price + small charge to cover minor expend.	
Passenger stations - buildings	Market rates	To be agreed	Commercial terms	Yes	Large lump sum per annum + a minor flexible payment	Not relevant
Passenger stations - passenger acccess/ charging functions	none	To be agreed	Per stopping train, differs greatly	Per train, two different tariffs	Large lump sum per annum + a minor flexible payment	Not relevant
Freight terminals	Range of charging methods: Non-discriminatory tariffs, commercial terms, share of maintenance costs	Terminals for combined transport free	According to agreements	Non-discrimination	Range of charging methods: agreements, regulated prices, included in access charge	Annual charge
Marshalling yards	Yard use: M based tariff, Marshalling: non-discriminatory	-	Agreements	No specific	Non-discriminatory	Charging per train
Train formation facilities	30% of maintenance costs. Commercial terms	Where relevant, to be agreed under new tendering regime	Different tariffs dependent on quality, that is connection to other tracks and electrification or not. Each track is charged for the time it is used. More expensive when shorter time than one year.	none	negotiated	-
Storage sidings	30% of maintenance costs. Commercial terms	Not as yet decided	Different tariffs dependent on quality, that is connection to other tracks and electrification or not. Each track is charged for the time it is used. More expensive when shorter time than one year.	none	negotiated	yes
Maintenance and other technical facilities	Commercial terms	Commercial terms	Commercial terms	Commercial basis or none	Commercial terms	-

Source: adapted from Hylén (2001: Annex 1).

There is some evidence that access to these kinds of ancillary facilities can prove problematic from a competition perspective. For example, a survey of the experience of German train operating companies seeking access to the DB Netz system found that a significant proportion experienced problems in accessing ancillary services, as follows:

- parking lines: 49% of respondents found access to be 'complicated'
- sidings: 32% complicated
- marshalling yards: 27% complicated
- maintenance plants:14% complicated
- washing bays: 18% complicated, 5% denied access altogether
- operation yards: 18% complicated, 3% denied
- filling stations: 8% complicated.[68]

The extent to which access to these ancillary services and facilities will be needed to facilitate competition between operators will depend on the type of freight load they are carrying, and their ability to either self-provide such facilities, or purchase access to such facilities from a competitor. The smaller the firm trying to enter the market is, the more likely it is that access to these ancillary facilities will be necessary to facilitate their ability to offer services. Although further research will be needed on the extent to which access to ancillary services is important to facilitate competition in South African rail, it would likely be preferable to begin to offer access to some facilities as early in the process as possible.

In the Australian rail sector, access undertakings typically include a description of the essential elements of the access agreement, which is somewhat analogous to the minimum access package used by the EU, but includes considerably more detail. For example, in the Interstate Access Undertaking, the essential elements include non-exclusive access to the network and an obligation on the ARTC to 'conduct Train Control, issue Instructions, maintain and operate the Network in a non-discriminatory manner,' and extend to such details as the placing of an obligation on the access seeker to provide warranties on the rolling stock and an agreement that 'contracted capacity not utilised seven out of twelve times may be withdrawn by ARTC.'[69]

The indicative access charge is then set in reference to a fairly narrow set of technical parameters, as follows:

> 4.6(a)(i) maximum axle load of 21 tonnes;
>
> (ii) maximum speed of 110 km/h; and
>
> (iii) length not exceeding
>
> > (A) 1800 metres west of Adelaide and Parkes;
> >
> > (B) 1500 metres east of Adelaide and Parkes …;
> >
> > (C) 1800 metres on the Segments Melbourne — Macarthur and Parkes–Cootamundra ….'[70]

[68] Zauner (2004: 16-17).

[69] ARTC Interstate Access Undertaking (2008: Schedule C).

[70] ARTC Interstate Access Undertaking (2008: 24-25).

3.3 Structure of access charges

Access charges typically are set up so that the charge differs in accordance with some measure of intensity of infrastructure use (the main exception to this system is two-part tariff systems, which are discussed in Box 3 below). As pointed out by Nash et al (2005: 35), the relevant measure of use in these kinds of 'simple' tariffs can include:

> gross tonne-km, net tonnekm, passenger-km, train-km, kW and kWh of electric traction used, per cent of revenue, etc. These can be weighted by speed, axle loadings, types of rolling stock, the specific route (including the geometry requirements of the route), time of day, and freight commodity, among many others.

Setting access charges on the basis of such measures of use allows marginal costs to be attributed based on factors which affect the real cost of service provision, and allows fixed costs to be distributed in an impartial and rules-based manner. Nash et al (2005: 36-43) further break down the calculation of access charge components into a number of subcategories, which are briefly summarized below, and supplemented with an analysis of Australian practice.

Maintenance and renewals

When trains use track infrastructure they affect infrastructure costs in two ways: firstly, every trip will increase the costs of maintaining the line, and secondly, every trip will slightly decrease the amount of time it will take before a major investment in a renewal of track infrastructure needs to be undertaken. Maintenance and renewals/major periodic maintenance costs are thus a key component of the marginal cost of train access.

The simplest way of differentiating between trains in terms of the impact they have on maintenance and renewals costs is to institute a charge based on gross ton kilometers, as train weight is probably the main cause of these costs. However, other factors also impact maintenance and renewal costs, including 'the design of the rolling stock (e.g., axle weight, unsprung mass) and the maximum speed of the train, as well as the characteristics of the track,[71] and more sophisticated tariff systems can and do take such factors into account.

In the Hunter Valley access undertaking, major periodic maintenance costs are included as a component of variable maintenance costs, which are then allocated to access seekers on either a gross ton kilometer usage basis (weighted for axle load), or on a train kilometer usage basis.[72]

[71] Nash, Matthews, & Thompson (2005: 36).

[72] Hunter Valley Coal Network Access Undertaking (2011: 36).

Train planning and operations

Train planning costs are unlikely to vary materially on the margin — in other words, the marginal cost to the infrastructure manager of planning an additional train path is probably close to zero. Nevertheless, in many EU countries train planning costs are recovered as part of the access fee (and are thus treated as a form of marginal cost). The manner in which this charge is designed varies substantially, from a fee per train path in Hungary and Italy, to a per train kilometer fee in Switzerland and a monthly charge in France.

In Australia, the Interstate access undertaking also explicitly includes train planning and operations administration as an element of incremental cost, and thus as a driver of the floor access charge.[73] There appears to be no separate charge for train planning, however, and no explicit mention of train planning costs is however made in other access undertakings examined.

Power

While it is possible to simply pass through the cost of power to the access seeker, in practice there are a fairly wide range of charging practices in the EU (some of which are set out in Table 2). In some countries a fee is also charged for wear and tear on the overhead catenary wires which supply electricity. Australian access undertakings do not include clauses relating to the purchase of traction energy sources, which are thus presumably contracted for independently, and possibly from third parties.

Congestion charges and external costs

When a route is congested, any new train on that route will affect the efficiency of all other operators on the route. It may also reflect a section of the route where demand elasticity is low, and thus the operator has greater freedom to raise prices. In either case, some form of additional charge to reflect the congestion on the route may be appropriate. Conversely, where routes are not congested, these kinds of fees should not be imposed.

In the EU, the manner in which scarcity charges are implemented varies substantially, as follows:

> Only Great Britain has a congestion charge per train-km explicitly related to estimates of congestion costs. However, charges per train-km in Italy and Germany vary by train speed and type of route. In Germany there is an explicit utilization factor, with a higher charge for heavily used lines. Italy uses a simple approach of setting standard speed profiles for each route designed to optimize the line, and charging higher prices for paths that deviate from the profile, either by seeking faster or slower paths that disrupt the optimal service profile. Slovenia is proposing an off-peak discount. There is also a charge per node in Switzerland and Italy that varies with the implicit amount of congestion at the node by categorizing nodes according to traffic levels.[74]

In the Australian Interstate access undertaking, specific segments are identified as high congestion (for example, Adelaide – Parkeston), and congestion charges are then specified on an hourly basis for each segment, presumably with higher charges for more congested segments. On those segments, the congestion charge then only applies when the train path deviates from an optimized

[73] ARTC Interstate Access Undertaking (2008: 21).

[74] Nash, Matthews, & Thompson (2005: 38).

speed profile, which is similar to the method used in Italy. This is set out in the undertaking as follows:

> 4.5(e) The excess network occupancy component will only apply where the Applicant seeks to contract a Train Path on the Network, which is in excess of:
>
> (i) a reasonable allowance for section run times for the applicable Train service type as determined by ARTC;
>
> (ii) dwells for crossing and passing other Trains as determined and made available by ARTC for the Train Path; and
>
> (iii) an allowance for the reasonable requirements for operational activities whilst the Train occupies the Network[75]

Additional charges are also sometimes imposed for externalities such as carbon emissions. For example, emissions fees are charged (by the government, not the infrastructure manager) to diesel users in Finland, Norway and Sweden.

Box 3: Two-part tariffs

As has already been discussed, the high fixed cost nature of the rail sector poses some problems when setting prices. This is because the most efficient economic outcome is associated with marginal cost pricing, but marginal cost pricing does not recover fixed costs, and thus requires fixed costs to be funded in a different way. In theory, this could be solved by implementing two-part tariffs, with a fixed fee which corresponds to fixed costs, and a per use fee which is set at a level sufficient to cover marginal costs. In this way, the marginal cost pricing signal could be preserved, without sacrificing the commercial sustainability of the infrastructure.[76]

In practice, however, two-part tariffs have been of limited implementation. They can be of use when setting prices for concessions, as the cost of the infrastructure can be front-loaded into a fee payable by the concessionaire at the start of the concession, with access fees thereafter set at marginal cost. Outside of the concessioning environment however two-part tariffs are seldom used.

Mark ups to recover fixed costs

As discussed in section 2.2, marginal costs can be regarded as the floor below which access prices should not fall. In a Ramsey-type pricing system, therefore, the way in which fixed costs are distributed between customers will probably comprise the bulk of the price differentiation between them. The price elasticity of customers thus is a primary determinant of how prices are marked up to recover fixed costs, in both EU and Australian rail systems.

In addition, it may at times be desirable to put mark-ups on new pieces of infrastructure to help finance their costs. For example, the cost of the Øresund Bridge between Denmark and Sweden, and the Storebælt Bridge between two Danish islands, was funded by specific bridge tolls per train. Nash et al (2005: 41) argue that this created an incentive to make trains crossing the bridge as long as possible, which may have then affected the efficiency of the freight service. In addition, the

[75] ARTC Interstate Access Undertaking (2008: 24).

[76] Nash, Matthews, & Thompson (2005: 35)

bridge fees may reduce the amount of traffic using the bridges, and thus increase the amount of time needed to recoup the investment. This kind of mark-up on specific pieces of infrastructure should thus be used as seldom as possible.

3.4 Time frame of pricing reviews

A practical question of pertinence when considering rail access pricing is how frequently pricing terms need to be reviewed. Longer term pricing systems can provide more certainty and stability to the pricing system, but also may struggle to cope, should substantial shocks be experienced to demand or cost of production, for example. A 2015 study of European access charging practices found that the bulk of countries surveyed had a pricing system which was annual in nature, with the single exception being the UK, which had implemented a five-year price review process.[77]

In practical terms, different elements of the access pricing system will need a different approach as regards the frequency with which they are reviewed. For example, the regulatory asset base will need to be valued based on fairly infrequent engineering assessments, with the annual valuation then rolled forward in a rules-based fashion. This is consistent with the approach taken to the RAB in the Australian Interstate access undertaking, for example.[78]

Depending on the price regulation method chosen, more volatile and unpredictable components of the price setting process could include volume forecasts (which would be necessary in a required revenue methodology). The Ports Regulator of South Africa currently sets its pricing methodology on a three-year basis, but then conducts annual price reviews partly to compensate for the 'large variations in the users and usage of port infrastructure and services' which could otherwise contribute to substantial variations in tariff levels.[79] Something of the sort is likely to also be of practical application in the South African rail context, and consultations will need to be held to determine what time frame is most suitable for tariff review going forward.

4 An access price proposal for South African rail

From the review of international and local practice detailed above, it is now possible to set out a proposal as regards the access pricing system which would be most appropriate for South African circumstances. This proposal is envisaged as the first step in a process of access pricing that will soon include the sector regulator to be implemented by the Economic Regulation of Transport Bill. The proposal will thus take into account both what is possible given current data availability, and what improvements may be made to the access pricing system over time.

While the bulk of the proposal concerns the technical aspects of the access pricing system, in practice access pricing will require an iterative process of engagement between sector stakeholders, and thus the necessary elements of this process will also be touched on. Lastly, the proposed access pricing system will have implications for wider transport policy, which will be dealt with separately.

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[77] IRG-Rail (2015: 7-9).

[78] ARTC Interstate Access Undertaking (2008: 22).

[79] Ports Regulator of South Africa (2020(a): 6).

4.1 A proposed access pricing system

Given the high fixed cost nature of rail, it is critical to maximise the volumes of traffic moved on the network in order to facilitate the efficiency of the system as a whole. For this reason, and given the extent of intermodal competition rail faces from road, it is crucial that any access pricing scheme allows for price differentiation between customers, so that price elastic customers can be offered lower prices than price inelastic customers.

In a price differentiated system, safeguards need to be put in place to prevent abusive pricing practices, and to ensure that the competitive playing field between access seekers remains level. These competitive safeguards need to include the following elements:

- A price floor below which access prices cannot fall. This should be set at a measure of marginal cost.
- A price ceiling above which access prices cannot rise. This can be estimated by determining an access price that is consistent with full cost recovery, where assets are valued on a depreciated optimized replacement cost basis.
- A commitment to setting the prices that comparable customers are offered at the same level across the network. While some exceptions may be made for segments in which track has very different cost characteristics (for example, on high-speed rail track), across the rest of the network prices should be consistent, in order to ensure that access seekers are on a level playing field when competing for the business of freight owners.

The floor price should include at least the following elements:

- The marginal costs of wear and tear on the track infrastructure associated with running the train in question.
- The costs associated with the acceleration of the next major renewal of the infrastructure, associated with running the train in question.
- A fee for train planning and operating services.
- Costs associated with any unusual service characteristics of the train, for example extra staff costs if the train is operating outside of normal operating hours.

The ceiling price should be set at a price which approximates the cost to a hypothetical new entrant of establishing the service from scratch, on a stand-alone basis. The simplest manner in which this can be calculated is to base it on a depreciated optimized replacement cost of the network assets. While more complicated methods of calculating the ceiling price may be appropriate going forward, this method will provide an adequate starting point.

To start off third-party access pricing systems, a pricing framework which only limits the IM to the floor and ceiling prices should be sufficient to provide a reasonably efficient market outcome. Going forward, however, a more formal regulatory approach would probably need to provide more oversight over the structure of prices. The pricing methodology which is recommended is a required revenue approach, where required revenue is set with reference to the depreciated historical value of assets. Ideally the price regulation method should also include some incentives for achievement of efficiency metrics. Should the IM be required to open network segments which are not feasibly commercially sustainable, it would be preferable to have these network segments financed by state subsidies rather than by cross-subsidization from more profitable network segments. These issues are discussed in more depth in Box 4 below.

Box 4: A more formal framework for subsidization

At present there is very little subsidization of rail in South Africa, and where subsidization does occur, it is only in passenger rail. While freight rail is often commercially viable without subsidies, international experience suggests that subsidization of freight rail is often necessary. Moving freight from road to rail is moreover an explicit policy objective in South Africa, and much of the current debate on third-party access centres on the re-opening of branch lines, which were previously closed as they were viewed as not being commercially sustainable.

If the IM is pressured to open commercially unsustainable branch lines without subsidization, the implicit expectation is likely to be that they will cross-subsidise such lines by increasing charges on more profitable parts of the network. This kind of cross-subsidization would then tend to push customers off the core freight network, by making access to it more expensive. The potential for this policy to produce perverse outcomes and push more traffic on to the road network is thus substantial.

Going forward, the third-party access pricing system will generate the type of data that will allow policymakers and the IM to have evidence-based converzations about whether a given route has any potential to be profitable/self-sustaining. If a route does not have a realistic chance of covering its costs, then any policymaker who wants to open the route will need to be prepared to provide finding to the IM to do so. The IM should furthermore have the right to refuse to open routes which need subsidization, if that subsidization is not forthcoming.

A further recommendation is that the Transport Regulator should be the body which assesses the need for subsidization, and provides a point estimate of the level of subsidization needed from the state. The goal of the Regulator should be to ensure that, if the IM is required to open commercially unviable network segments by the state, it will then receive subsidies which allow it to continue to make a sustainable level of profit across its business as a whole, without cross-subsidization between services. The Transport Regulator would also be well placed to assess on an ongoing basis whether the operator is making good faith attempts to improve the viability of these lines, and to adjust the level of subsidization as needed. Some provision is already made in the Economic Regulation of Transport Bill 2020 (see section 11(5)) for coordination between the Regulator and any subsidising party, and regulations can be prescribed subsequent to the enactment of the Bill to give force to these recommendations.

Box 5: Security costs

An unusual feature of South African rail is the extent of theft and vandalism of network assets. This has a number of cost implications for the infrastructure manager, in terms of hiring more security staff and equipment, the costs of replacing and repairing damaged and stolen equipment, and the service delays and even possibly damage to rolling stock caused by damaged and stolen equipment.

It is reasonable to expect the infrastructure manager to employ security staff, and to take responsibility for facility security, especially as regards stations and freight in facilities like marshalling yards. Such security costs should be included in access charges, and it is reasonable to have a penalty structure which penalises the IM to some extent for failures in these security systems. However, where theft and vandalism occurs on a massive scale, or is associated with coordinated criminal activity that is not effectively dealt with by police, it may be counterproductive to simply penalise the IM for these outcomes. An access charge structure which penalises the IM for security failures which are outside of its control will not improve system outcomes. In effect, these kinds of costs may need to be handled through interactions with the justice system and other components of government, rather than the access charging system.

Access charges will need to be set with reference to a minimum access package, which should include train specifications such as speed, weight and train length, as well as detail on whether access will be provided to ancillary facilities. It may be useful to determine more than one access package type, for example for areas of the network which have materially different technical specifications. The exact components of the floor and ceiling prices will thus need to be

determined with regard to what is included in the access package, and as the access package will need to be workshopped with the infrastructure manager, a precise outline of the components of the floor price is not possible at this time. The treatment of security costs may also need additional attention, as per the discussion in Box 5.

Consultations with sector participants have confirmed that the quality of service offered, in terms of speed and reliability in particular, are important components of rail freight competition. The minimum access package should thus not constrain the ability of the access seeker to control the quality of their service offering. It is thus essential that access seekers be able to provide a seamless origin-to-destination service to their customers, without needing to hand over control of freight to the incumbent operator at any point. In addition, it is highly recommended that access seekers be allowed to run their own rolling stock, purchase energy sources like diesel independently (where technically feasible), and staff trains with their own employees. This being said, those access seekers who wish to purchase these products and services from the infrastructure manager should be free to do so on a willing buyer, willing seller basis.[80]

The importance of competition with regards to the quality of service also means that it will be crucial for access pricing to include a penalties regime, on the infrastructure manager as well as the access seeker. This penalty regime should try to incentivise all parties to improve system efficiency, and to minimize any potential negative impact their operations could have on those of others. The level of penalties should thus be set with regards to what would be an effective deterrent/incentive, rather than with regards to the level of damage caused to others (not least because the damages associated with a single incident may dwarf the ability to pay of a single operator). A penalty system which is based on the average level of service achieved may be more effective in achieving cooperative, efficiency focused outcomes than one which focuses on attributing blame on a case-by-case basis. The potential for the penalty regime to produce unanticipated and perverse outcomes will however be substantial, and this is an area of the third-party access system that is likely to need additional analysis and oversight.

Once the minimum access package/(s) have been determined, price setting should then be a transparent rules-based process. Access charges should be modified in line with the factors that affect the cost of service provision, such as train weight and speed. So for example a train which is longer than the basic access package, or wants to travel faster than the optimal speed, should then be charged more, and vice versa. It will also be desirable to include transparent rules-based modifiers for factors that affect price elasticity. For example, it will likely be desirable to differentiate prices between freight and passenger trains, and, where possible, by freight type.

The access fee should vary with usage of the network. A train kilometer or ton kilometer measure, for example, should form the basis of the charge. Additional charges can then be included for use of facilities like stations and marshalling yards (although consideration should also be given to including access to some basic facilities, as appropriate, into the overall access charge). The recommended approach to congestion charging is to design the minimum access package to minimize congestion, and then charge more for train configurations which deviate from these specifications, and thus will affect system efficiency.

This access pricing proposal can be adapted for use by both freight and passenger access seekers, and price modifiers should take into account whether the access seeker is a passenger or freight

[80] An exception to this may be as regards the training of drivers. If drivers need to be trained by experienced drivers before they can travel a route, and the incumbent operator employs all the experienced drivers, it may be advisable to put in place an obligation to provide route training.

service. The ultimate manner in which price modifiers are designed will however need to take into account the commercial sustainability of the network, and the wider policy environment. For example, while from an equity point of view the argument can be made that commuter passenger services should only be charged the marginal cost of access, this will not be possible if doing so affects the commercial sustainability of the IM.

It is likely that the pricing proposal above would however not be suitable for concessionaires. Instead, it may be possible to load the fixed cost of the network into an up-front fee for concessionaires, with access prices subsequently set at marginal cost. Further consideration of a suitable pricing model will thus be needed if, for example, a decision is made to concession short distance passenger rail in each metro.

4.2 Process steps in finalizing access pricing

It is difficult to predict exactly what process will be required in order to finalise third-party rail access pricing systems. However, some components of this process are foreseeable, and are discussed below.

Regulatory asset base exercise

In order to set access prices based on a required revenue approach, it will be essential to produce an estimate of the value of the regulatory asset base of the infrastructure manager. Transnet Freight Rail already has a great deal of information available as regards its asset base. It undertakes an asset valuation exercise every three years, for internal purposes, using the services of external consultants. This valuation exercise is undertaken on a DORC basis on a sample of assets across different parts of the Transnet rail network, and will thus provide data which can be used to set the ceiling level of the access price. While eventually the Transport Regulator will need to conduct its own independent DORC asset valuation exercise, the results of this internal valuation will provide valuable inputs at the initiation of the access pricing process, specifically as regards the determination of access price ceilings.

Transnet also maintains an asset register for the freight rail system, which includes the historical value of assets, as well as some information about their condition. This data can be used to begin to estimate the trended original cost of the asset base, in order to determine an appropriate level of required revenue for the IM. Going forward, the regulator will need to review the asset register to determine whether all assets included in it are appropriate — for example, whether they should be more appropriately attributed to the freight operator, or whether they are either currently in use or in usable condition. Adjustments may also be needed for older assets which are already fully or largely depreciated.

Cost attribution exercise

A large component of the marginal costs of providing access is the impact each train has on maintenance and renewal costs. In order to accurately estimate this element of marginal cost, the access pricing model needs to be able to attribute which infrastructure expenditures should be regarded as marginal versus fixed cost expenditures. A simple way to conduct an initial cost attribution exercise for South African rail would be to use the estimates developed by experts in the German rail system (as shown in Table 1) as a starting point. These estimates could then be interrogated by local engineering experts to determine whether adjustments are needed to take into account South African conditions.

Market segmentation and minimum access package exercise

A minimum access package proposal will need to be developed by the IM, and ideally consultations should be held with access seekers before it is finalized. Ideally the minimum access package should be designed to allow access seekers to provide services which are competitive with those of the incumbent operator, and which give access seekers significant control over the quality of service they are able to offer freight owners. The minimum access package should also take into account the ideal service specifications for a given section of track, in order to maximise the capacity and efficiency of service.

Market segmentation is linked to the minimum access package, to the extent that it is likely to be desirable to offer slightly different specifications of the minimum access package on segments of the network which have materially different technical or operational characteristics. Market segmentation will also need to take into account variations in customer price elasticities. Care will need to be taken to ensure that the market segmentation exercise remains consistent with South African competition law, and regulatory oversight of this exercise will be needed before it is finalized.

4.3 Facilitating third-party access

While access pricing systems are an important component of a third-party access regime, establishing the right price will not be sufficient to facilitate competition unless a number of additional issues are addressed. The most important of these are outlined below.

Vertical separation

Transnet Freight Rail is currently in the process of instituting accounting separation between its infrastructure manager and freight operator, and the process is expected to be completed by March 2021. Accounting separation will be an important component of establishing accurate cost estimates, and is necessary to provide a reasonably accurate estimate of key components of marginal cost pricing. Accounting separation should also help to more clearly establish which assets should properly be included in the regulatory asset base of the IM, which will be a regulated entity, as opposed to the rail operator, which will be unregulated and exposed to competition from new market entrants.

While full vertical separation will not be necessary to initiate third-party access to the rail network, accounting separation alone will not be sufficient. It will be crucial for vertical separation to have progressed to a point where adequate mechanisms can be put in place to ensure the confidentiality of access seekers. The IM will have substantial commercially sensitive information about the freight customers of access seekers, and if care is not taken to ensure that this data is ringfenced from the incumbent freight operator, then there will be potential for it to be used to enable poaching of clients from new entrants. Evidence from the German experience, where the infrastructure manager was vertically separated from the freight operator, but both continued to be owned by the same holding company, suggests that the potential for anti-competitive use of information advantages is real.[81]

The kinds of data ringfencing measures needed will include the separation of information systems, possible physical separation of office facilities, and will probably extend to a separation of

[81] Link (2003: 45).

management and reporting lines. A proposed approach to ensuring confidentiality by Transnet should be vetted by an independent third-party (ideally, the Transport Regulator).

A framework for discussing financial sustainability

Once vertical separation has taken place, the main source of income of the infrastructure manager will be access fees. As such, setting access fees on a cost-related basis will become key to the sustainability of the IM. While perfect accuracy in cost estimation will never be possible, it would be problematic to start the access pricing process with a cost estimate which was very far off the mark. The more incorrect the price is at the beginning of the process, the longer it will take to adjust prices over time to a level which can truly facilitate sector sustainability efficiency. Some care will thus need to be taken with the process of establishing access prices, and excessive haste in initiating third-party access may lead to much larger problems down the line.

Once a reasonably accurate cost-based estimate of required revenue can be generated, however, it will allow the establishment of a more rigorous framework for discussions as regards the financial viability of specific network segments, and thus the need for subsidization. Ideally the infrastructure manager should have some formal ability to begin discussions as regards a potential need for subsidization with provincial transport authorities, for example, when financial modelling suggests that a specific segment of the network is not commercially sustainable. The ultimate objective should be to establish a more formal framework for determining whether to open or close network segments, as well as to determine the need for subsidization, than currently exists.

Capacity allocation systems

The ability of new entrants to compete for rail freight business is dependent on their ability to get slots on the network. The type of slots they are allocated will also affect the quality of service they are able to offer, depending on the time of day which is made available, the quality of track which is made available, and other such factors. The manner in which capacity allocation decisions are made is thus central to facilitating network competition, and some oversight of this system will be needed to ensure that competitive fairness is safeguarded.

A formal system will need to be put in place to deal with allegations that capacity is not available at all. The realized capacity of a specific piece of track depends to a large extent on how it is managed, and changes to the way trains are made up and scheduled can sometimes free up material capacity. There thus needs to be an obligation on the infrastructure manager to review its practices and try and free up more capacity, if access requests are made which cannot be fulfilled.

Creating more capacity may also require further investment in infrastructure. While in some cases major investments may be needed, in other cases it may be possible to create more slots by relatively minor incremental investments, for example to rehabilitate disused passing sidings. Smaller investments can often be implemented more quickly, and keep infrastructure costs lower. There thus also needs to be an obligation on the infrastructure manager to determine the least cost/most efficient means of creating a new slot, as and when access requests exceed available capacity.

Finally, a transparent, rules-based means of allocating capacity will be needed, which does not favour any operator. Typically such systems prioritise passenger operations during rush hour, for example, and provide better access to full rather than empty trains. Transnet's train planning system likely has a preference system in place already which can be used to develop such a system. Care will however need to be taken to ensure that an implicit preference for TFR trains is not carried forward into a new system.

Network statement

Many of the practical problems that arise for access seekers on a rail network have to do with the information asymmetry that exists between the infrastructure manager (and arguably the incumbent operator) and new access seekers. It can be difficult for an access seeker to understand what kind of trains can run on which parts of the network, and to understand whether the grounds for denial of access, if that occurs, are valid. One way of addressing this information asymmetry is to require the infrastructure manager to issue a network statement, which contains detailed information on the technical specifications of track and ancillary facilities, as well as the capacity allocation systems (as discussed above), procedures for dealing with dangerous goods, cancellation rules, the penalty system, the access charging system, and so on and so forth. The network statement can also be a useful central point to list contact details for the various people an access seeker may need to speak to at the infrastructure manager.

It would be useful for Transnet as infrastructure manager to issue such a network statement, in order to facilitate the type of information flow needed to underpin a functional third-party access system. Some of the information needed will only be finalized as the third-party access regime itself is finalized, but an initial network statement could begin simply by specifying the geographical location and technical specifications of the track and ancillary facilities. Annual updates would then be needed to ensure the information remains current, and to include the finalized details of the access proposal.

Third-party access in passenger rail

Much of the focus of this report has been on freight rail, to some extent because the policy position around freight rail is clearer at present. However, third-party access also has great potential in passenger rail. The metro rail systems in the major South African cities are separable systems which can potentially be concessioned to new entrants, and in a number of cases those concessions will need access to the TFR network to function. In addition, freight access seekers may in future seek access to the network currently owned by the passenger rail operator.

The complexity of the issues faced by the passenger rail sector far exceed the scope of this report, with the security issues discussed in Box 5 being of particular urgency. However, as vertical separation of the track infrastructure manager is pursued at Transnet, an obvious question which must be raised is whether such vertical separation should also be pursued in passenger rail, and whether in fact all government owned rail infrastructure should be managed by a single state-owned entity?

If concessioning is pursued in passenger rail, the access pricing system can potentially be quite different from the model proposed in this report. A two part tariff, where access prices are set at marginal cost, but the concessionaire pays an upfront fee which covers fixed costs, would then be efficiency enhancing. In practice, much of the cost of passenger rail eventually will fall on the state, and the ability to evaluate the cost of service provision and thus the shortfall requiring subsidization, and the ability to motivate concessionaires to improve efficiency and reduce the required subsidy, becomes paramount.

4.4 Potential pitfalls

While the introduction of third-party access in rail has great potential to improve the efficiency of the sector, like any major policy initiative it also carries with it a number of risks. Some of these risks increase if third-party access is implemented before the institution of the Transport

Economic Regulator, which has been raised as a possibility. It is thus worth flagging some of these concerns at this point.

While accounting separation is currently being implemented between Transnet's infrastructure manager and freight rail operator, there is no plan in place to divest the infrastructure manager from Transnet. Such divestiture is not a necessary pre-requisite for third-party access, but if Transnet continues to retain both the IM and rail freight operations this will require rigorous governance systems to be put in place. This is because a market structure where an upstream monopoly firm (such as the IM) is vertically integrated into downstream markets which are potentially competitive (rail freight operations), is well known to be prone to certain types of competitive abuses.

These potential problems are particularly acute if the upstream firm is subject to price regulation, and thus is unable to realise monopoly profits upstream. In that case, there is an incentive for the upstream firm to limit competition in the downstream market, so that its downstream sister company can raise prices and reap monopoly profits. However, even if prices upstream are not regulated, and there is not a particularly strong incentive on the upstream firm to try and foreclose the downstream market, competition problems may still occur. If the staff of the IM continue to behave as members of the wider corporate entity, and hold its interests to heart, then it is likely that the confidential information of access seekers will be leaked internally, and access requests from its downstream sister company will be treated preferentially. At minimum, therefore, proper functional separation of the IM from the freight operator, accompanied by protection of confidential data of access seekers, must be in place before third-party access begins.

A separate issue which is worth flagging at this point is the potential concessioning of the ore lines. An argument can be made that these lines are crucial to the operation of the mines they serve, and thus that it would make sense, and would help raise capital for the rest of the network, to concession these lines. In practice, though, the price differentiation approach to access prices set out above implies that it is essential to retain more profitable lines within the network, as higher profits on those lines can help to sustain overall profitability. If the most profitable parts of the network are sold, then sustaining the rest of the network on a commercial basis will become more difficult to achieve, and government subsidies are more likely to be needed going forward. Conversely, the proposed concessioning of branch lines which are currently closed is problematic precisely because most of these lines are unlikely to be profitable. Transnet originally closed these lines because their volumes were low, and while some of them may now have commercial merit, most will not. These lines will thus either need to be cross-subsidised from the rest of the network (and some financial guidelines will be needed to assess whether this is viable, or will place an unacceptable financial burden on other customers), or provided with state subsidies. At present TFR is reported to be offering prospective concessionaires an access price which is calculated based on segmental traffic densities — thus much higher than the rest of the network, given the low densities involved. This solves the lack of subsidization, but also ensures that no access seeker will likely ever have a commercial case to use the line. Without a clearer framework for the consideration of subsidization needs, branch line concessioning could prove to be a waste of time for policymakers.

5 Conclusions

South Africa's substantial rail network is an important national asset, which has the potential to facilitate economic growth and support employment creation. At present, while the freight volumes moving via rail have been fairly well sustained, the quality of service provision is in many

cases not competitive, and passenger rail performance has deteriorated drastically. The introduction of competitive third-party access has the potential to revive the sector by introducing competition, particularly as regards service quality.

While care must be taken to ensure that access pricing levels ensure the sustainability of the sector, the potential benefits that can accrue are substantial. Differentiated access prices have the potential to pull traffic onto the rail network which has previously travelled by road, and by doing so will allow the infrastructure manager to spread the costs of fixed infrastructure more widely, and thus improve network efficiency. This will directly address the density economies which are so critical to rail, summed up by the World Bank as follows:

> These economies of density are substantial on their own. But when combined with the impossibility of storing unused train paths, they create a convincing case that railway infrastructure networks' financial sustainability depends critically on high traffic volumes. Good railway network economics requires high infrastructure utilization - the higher the utilization, the better the infrastructure economics.[82]

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Annex 1: Market segmentation for long-distance passenger transport and freight, German rail system

	Long-distance passenger transport	Rail freight
Segmentation criterion	**Segments and definition**	
Relation	Metro[a] Other	Regional (<75 km)[h] Others
Time of day	Day: 6:00 – 20.00 Basic: 20:00 – 23:00 Night: 23.00 – 06:00	
Speed	More than 160 km/h 100 – 160 km/h Up to 100 km/h	
Flexibility	Time flexibility for point-to-point: No flexibility ±30 min	Route flexibility: Yes/no Time flexibility: Low=±30 min High ±120 min
Connectivity	Point-to-Point traffic[d] Other	
Frequency	Up to 4 trains/day More than 4 trains/day	
Prioritization	Priority No priority	No priority Fast[f] Express[g]
Nostalgic trains		
Loco and empty runs		
Weight		Heavy (>3000t) Standard
Type of goods		Dangerous goods Other
Train length		Block train (up to 370m) Train with single wagons

Notes: (a) Refers to trains connecting so-called Metropolitan stations (defined as 44 with more than 50,000 travellers per day and 8 border stations with >5,250 trains/day, both RRPS and long-distance passengers. (d) Less than 3 connections. (f) Priority over other freight trains. (g) Priority over all other trains except High-priority passenger trains. (h) Restricted to trains below 3000t and below 370m length.

Source: adapted from Link (2018: 9–10).