PR18 STRUCTURE OF CHARGES REVIEW
MARKET CAN BEAR ANALYSIS: PASSENGER SERVICES

REPORT FOR THE OFFICE OF RAIL AND ROAD

14 NOVEMBER 2017

Revised Final Report

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This report has been revised and reissued following the location of an error in the version dated 29 September 2017.

Executive Summary

Background

The ORR is now in the process of undertaking the 2018 Period Review (PR18), which will culminate in the determination of what Network Rail must deliver within the next Control Period (CP6) and a review of the structure of access charges (SoC). Access charges are fees paid by train operators to gain use of the rail network.

One area of the charges review has involved examining how fixed network costs are recovered from both passenger and freight train operators. This report sets out a possible approach for identifying market segments for passenger rail services, and then conducts a "market can bear" (MCB) test for each of the identified segments in order to demonstrate which markets may have the ability to bear a mark-up above directly incurred costs, and can therefore contribute to fixed network costs.

The nature of this work is a proof of concept. We make an initial categorisation of services currently running on the network by market sector, subject to certain assumptions, and then set out an estimated range for ability to bear, based on this approach.

Context

'Mark-up' charging is described in The Railways (Access, Management and Licensing of Railway Undertakings) Regulations 2016. The legislation allows infrastructure managers to levy mark-ups above directly incurred cost on specific market segments, if the market segment can bear such charges. The Fixed Track Access Charge (FTAC) paid by franchised train operating companies (FTOC), and the Freight Specific Charge and Freight Only Line charge paid by some freight commodities in CP6 are existing mark-ups within the SoC. Open access operators (OAO) do not pay mark-ups currently.

ORR recently confirmed in a letter concluding on some elements of its SoC review that it will continue to "work towards levying charges to recover fixed network costs on **all** operators" in CP6.

In undertaking our analysis, we made a number of assumptions as advised by the ORR, the key ones being:

- Mark-ups for passenger services to be levied as a rate per train mile;
- No capacity charge in place for CP6; and
- No Public Service Obligation (PSO) levy[1] in place.

Currently OAOs pay a capacity charge of about £0.50 per train mile, while the national average is around £1.30 per train mile. This £0.50 is an indication of the **minimum** level of ability to

[1] A PSO levy is a device permitted by European legislation to protect the financial position of public authorities who fund public services. Introducing such a levy in the UK is being considered but would require legislation.

pay for existing OAOs, if the capacity charge were removed. The focus of our analysis has been on identifying the relevant market segments that appear to be able to bear charges above directly incurred cost, and quantifying ability to bear in such market segments. This is based on the assumption that operators are not constrained in terms of access to the network. As such, the ranges for ability to bear presented in Table 1 below, based on the stage 2 analysis, do not represent the range of ability to bear for existing OAOs. These have entered the market based on ORR's current access policy, which determines access through use of the "not primarily abstractive" test.

Data sources

In undertaking this analysis, we have used the best data sources available, and which we were able to access and process within the timescales available for this project. We have generally used National MOIRA1 for revenue modelling. We were restricted to public data for cost estimation, which means our cost estimates are approximate. We used 2015-16 data and timetables.

Our work revealed that National MOIRA1 has particular shortcomings for London Commuter flows in more complex parts of the network, so for some selected services we obtained more plausible results using MOIRA2. Our work also highlighted allocation difficulties that arise from making use of publicly available cost data. We nevertheless consider that the results are sufficiently clear to allow high-level conclusions to be drawn.

Stage 1 analysis

We investigated the operating surplus of all services running on the network, at service level. The measure of operating surplus we used is net revenue per train mile. This excludes government transfers or similar balancing payments received or made by franchised passenger operators. We define net revenue as follows:

Net revenue equals:

Passenger revenue – staff costs – fuel costs – rolling stock costs – other costs

Where

- ***"other costs" includes the variable access charges, but excludes the fixed track access charge, the capacity charge and government transfers; and***

"passenger revenue" excludes any government transfers.

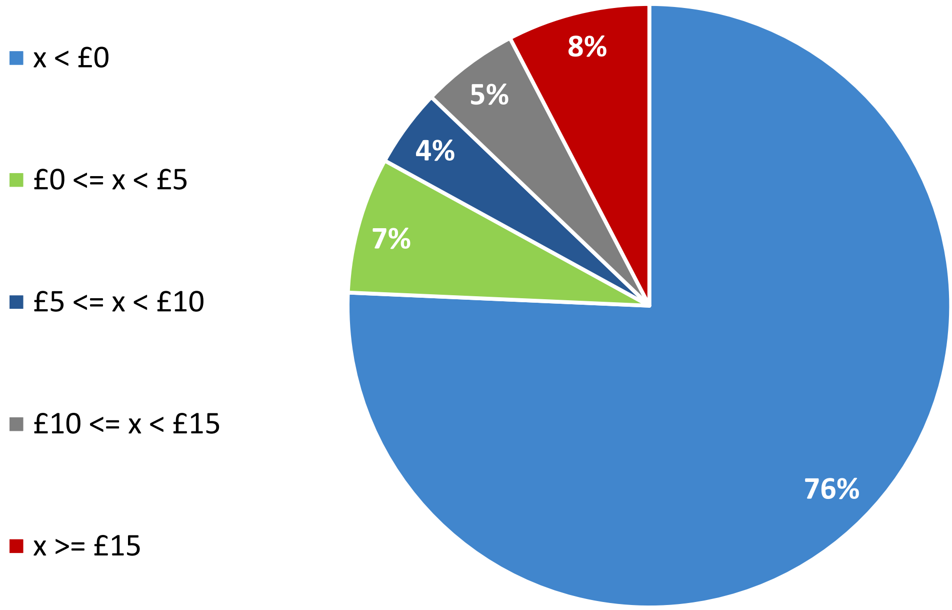
We calculated (statistically) average unit operating costs for services running on the network, distinguishing diesel and electric, and intercity, commuter and regional services, for each cost category in the ORR dataset. Total costs were then calibrated to the known total costs of each individual train operator (TOC).[2]

[2] This refers to both franchised and open access passenger operators.

We used MOIRA1 to identify revenues at the service level, calibrated to ORR data on TOC passenger revenues. Train and vehicle miles came from MOIRA, so as to match the timetable, adjusted for train movements out of service.

MOIRA revenue data is confidential and so we summarise the results anonymously by service code in the following figure.

Figure 2: Proportion of service codes by net revenue per train mile



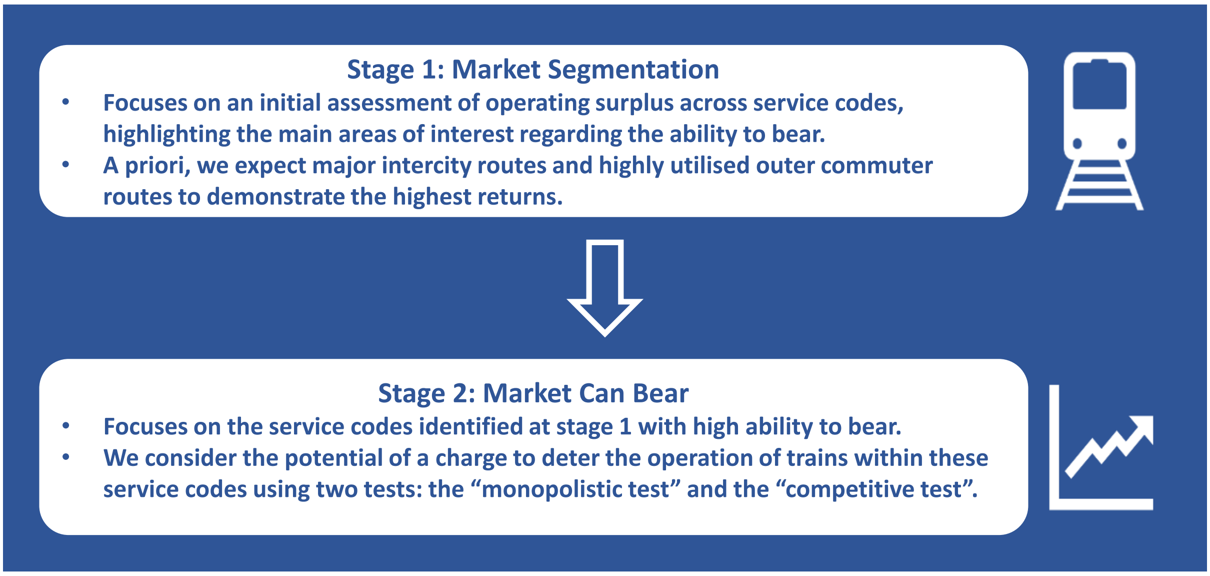
Source: CEPA analysis

The results indicate that the majority of services, when only considering passenger revenue, operate on a net revenue deficit (76%). By taking account of the fact that OAOs do not appear to be highly profitable, and their levels of net revenue per train mile based on this analysis, we conclude that the focus for a more detailed analysis of ability to bear is in service codes with a net revenue per train mile above that earned by the OAOs at an overall TOC level (around £4 - £5 per train mile).

Approach

Our analysis has been conducted in two stages as shown in the figure below.

Figure 1: Overall approach



Stage 2 analysis

In stage 2, we sought to apply a MCB test for a number of services (i.e. service codes) with the higher net revenues identified as part of the stage 1 analysis, as potentially having the ability to bear charges above directly incurred cost. The test we applied can be understood as follows:

In a competitive railway market, if one supplier reduces supply, then another supplier can seek to replace them in the path vacated. A question would be, in what circumstances would they be willing to take that path? MCB is related to the level of net revenue at which another operator would be willing to occupy the path. A mark-up charge can be borne if the path would be operated at that charge, because in a competitive market it would not deter the operation of that diagram.

Our arithmetic approach to estimating a plausible mark-up that is able to be borne is as follows:

We calculate a mark-up charge that is able to be borne on a route, in the absence of a "not primarily abstractive" restriction, as

Y – X

Where

X is the minimum net revenue per train mile from an open access operator's diagram MINUS current Capacity Charge per train mile

(Because the OAO is currently paying the Capacity Charge so this is the actual net revenue, whereas we have reported net revenue excluding it.)

And

Y = Typical earnings of FTOC per train mile on typical diagrams comparable to open access diagrams, i.e. excluding the most profitable diagrams and some outliers

The reasoning behind this is that X indicates the minimum net revenue acceptable to a free market entry operator, whereas Y indicates what they might be able to earn without entry restrictions. The difference is a charge that is able to be borne if they were without such restrictions. It could also be considered as indicating a surplus currently available to the funding authority that would be at risk of being competed away in the absence of entry restrictions.

We prepared five case studies. Their details are based on confidential data. A high level description of each is found below.

Table 1: High level description of Case Studies and high level conclusions noted

Case Study	Market situation	Observations
1	Intercity service towards the lower limit of Stage 1 net revenue per train mile of interest for charging. Some OAO competition on parts of the route.	We identified that the service code could conservatively[3] bear a mark-up of ✂ per train mile. This includes £0.50 for the current average capacity charge level for OAOs, assuming it does not apply in CP6.
2	Intercity service with somewhat higher net revenue per train mile compared with Case Study 1. Some OAO competition on parts of the route.	We identified that the service code could conservatively bear a mark-up of ✂ per train mile. This result was lower than expected, given the overall net revenue of this service is higher than Case Study 1. The reason is that demand is more peaked for this service, and off-peak net revenues are relatively lower. With a mark-up that does not vary by time of day, it is the off-peak that drives ability to bear such a mark-up.
3	Intercity service with high Stage 1 net revenue per train mile and no direct competition from an OAO or another franchised operator.	The mark-up from Case Studies 1 and 2 could easily be borne,[4] and potentially considerably more.
4	Outer commuter service with high Stage 1 net revenue per train mile and no close inter-franchise or OAO competition.	The mark-up from Case Studies 1 and 2 could easily be borne and potentially considerably more. This service lies intermediate between typical Intercity and Commuter services. The calculated level is very sensitive to cost assumptions and rolling

[3] Our modelling shows considerable sensitivity to the assumptions made, particularly to rolling stock choices, and as such we have been conservative in our interpretation of the results obtained.

[4] Based on case studies 1 and 2, and our professional judgement, we have identified a mark-up in the range of £6 to £7 per train mile which could be borne by intercity services of the nature considered in these case studies. (Footnote provided for purposes of redacted version.)

Case Study	Market situation	Observations
		stock choices, but clearly shows high ability to bear.
5	Outer commuter service with high Stage 1 net revenue per train mile, but with some major stops also served by franchised intercity service s.	Although overall the service code has high net revenue, some (more marginal) diagrams had relatively little ability to bear any mark-up, but this is sensitive to the rolling stock strategy selected. This result arises because (1) demand is heavily peaked; (2) a requirement to serve minor stations at a given frequency and journey time results in a high frequency to major stations and hence high off-peak excess capacity, which is costly to provide; and (3) substantial portions of revenue at major stations were being captured by the intercity service, and aspects of our conservative revenue modelling approach tended to accentuate this effect. It is evident from the overall revenue of the service code and related intercity service that the charge from Case Studies 1 and 2 ought to be able to be easily borne overall by an operator looking to exploit the commercial potential of this market. But it requires a very specific approach to segmentation to isolate quite where it would best be charged.

Conclusions

Our Stage 1 findings highlighted that the highest returns are typically achieved by services on the following types of routes:

- **Major intercity routes** – for example, services between London and other large UK cities like Birmingham, Manchester, Leeds and Liverpool.
- **Highly utilised, outer commuter routes** – for example, services between London and Colchester, Southampton and Cambridge.

Our confidential Stage 2 results suggest that ability to bear a charge varies considerably by route, as does the amount that could be borne. One of our case studies was carried out on services at the lower end of the range of services with average net revenue above the benchmark level of net operating revenue for existing OAOs, which, as set out above, we have taken to be the minimum level acceptable to a commercial operator. Therefore, our emerging view is that it is likely that most of the service codes identified by the Stage 1 assessment could bear a charge at the level emerging from that case study, of £6 to £7 per train mile. But those services that are closer to the edge of the category would require more careful examination.

At the same time, it does appear that some specific geographical markets might be able to bear higher charges. However, present service codes may not always be well aligned with geographical markets that can bear charges. Also, as things stand, existing OAOs would not be able to bear such a charge. That is because our estimates represent the value of diagrams to the FTOC, who have a number of advantages, including no timetabling restrictions such as those placed upon OAOs. The aim of our work has been to identify a range of ability to bear for potential unconstrained services operating in the markets we have identified as being of interest. Further analysis would be needed to develop this analysis into a charging proposal, including how to define specific market segments.

The Stage 2 analysis also revealed that the quantum of ability to bear a mark-up is contingent upon:

- How you define the market segment you are applying the charge to, and
- The other services and their capacity running in the same area, as a result of franchise requirements, and the intermediate stopping pattern of longer distance services.

In particular, we note that the presence of lower revenue service obligations and higher revenue major destinations in the same service code, and on the same train service, and the interleaving of shorter and longer distance trains, can make it difficult to untangle where ability to bear lies. We have also found that our results are quite sensitive to the assumptions made, and thus more careful analysis will be needed, especially in cases which lie close to the boundary of interest.

Notwithstanding that, we believe that we have identified the presence of substantial ability to bear a mark-up materially higher than the current capacity charge on major intercity routes, even those towards the lower end of interest in the Stage 1 analysis. This would also appear to be the case in the higher earning areas of outer commuter services identified in Stage 1. But the entanglement of less remunerative service obligations and the intermediate calls of longer distance services means that it is harder to define markets in a way that locates and isolates where ability lies in these markets.

1. INTRODUCTION

1.1. Background

The ORR is now in the process of undertaking the 2018 Period Review (PR18) which will culminate in the determination of what NR must deliver within the next Control Period (CP6) and a review of the structure of access charges (SoC). Access charges are fees paid by train operators to gain use of the rail network. Setting charges is an important part of aligning incentives in the GB rail industry, and ensuring that Network Rail, train operating companies and other operators are incentivised to make the best use of existing capacity on the network.

One area of the PR18 charges review involves examining how fixed network costs are recovered from both passenger and freight train operators, with the ORR recently confirming that it will continue to "work towards levying charges to recover fixed network costs on **all** operators", (emphasis in original), i.e. including the open access operators (OAOs) to date excluded from such a charge.[5]

The PR13 review considered a contribution to fixed costs being made by freight flows that could bear such a charge, and as a result, a new freight specific charge (FSC) was implemented for certain freight flows in CP5. This charge is levied based on the concept of identifying market segments within freight that could bear a charge. This project reviews the freight work undertaken in PR13 and seeks to extend the market can bear concept to passenger services.

1.2. Objectives of this study

The ORR has commissioned CEPA to undertake the market can bear analysis to inform its setting of infrastructure cost charges for CP6. The overall project, which has been split into passenger and freight work-streams, forms a continuation of the work completed by the ORR on the structure of costs and charges review in PR13.

This report focuses solely on the passenger elements of the work. It involves proposing a market segmentation for passenger rail services, and then conducting a "market can bear" test (MCB) for each of the identified market sectors[6] in order to demonstrate which markets may have the ability to bear a mark-up[7] above directly incurred costs, and can therefore contribute to fixed network costs. We also indicate the approximate range of ability to bear for those markets, based on case study analysis. However, this work represents a first stage analysis designed to provide proof of concept i.e. that a mark-up can be constructed for identified passenger markets able to bear the charge, and could be applied in practice using existing systems and data. It is likely that further consideration and refinement will be

5 ORR, *Charges and contractual incentives – consultation conclusions*, June 2017

6 We use the word "sector" except when specifically referring to the segments and segmentation mentioned in legislation.

7 We discuss ability to bear in full at section 2.8. In brief, we mean the ability of a market sector to absorb or pass on additional charges without experiencing a substantial reduction in traffic in that market sector.

required if such a charge were to be implemented in CP6. For example, service code definitions may require further analysis in order to develop the best definition of market segments for the purpose of levying a charge[8], and a more detailed and less approximate modelling of costs and revenues may also be required. We observe that the on-going Schedule 8 recalibration involves a consideration of how service codes should be designed better to match the charge to cost.

The analysis of the existing FSC is provided in a separate report.

1.3. Structure of the document

The document is structured as follows:

- **Section 2** provides the context to this study and introduces the key issues;
- **Section 3** gives an overview of our approach and outlines key data source and assumptions;
- **Section 4** contains details of our approach to stage 1 of the study and initial key findings;
- **Section 5** outlines our approach to stage 2 of the study and subsequent findings based on two fictional case studies; and
- **Section 6** concludes.

The main report is drafted for general publication and focuses on the process that we have undertaken, TOC level analysis using published ORR data, and illustrative examples to aid understanding. However, the underlying analysis relies upon confidential service code level cost and revenue data that cannot be placed in the public domain. The report is therefore supplemented with two confidential annexes that will not be published:

- **Annex A** contains revenue and cost adjustment factors used to calibrate data; and
- **Annex B** presents confidential case study analysis.

[8] A different classification of services into service codes, focused on their market potential, could better identify markets able to bear a mark-up than using the present service codes

2. CONTEXT AND KEY ISSUES

2.1. Legal context

'Mark-up' charging is described at Schedule 3, Section 2 of The Railways (Access, Management and Licensing of Railway Undertakings) Regulations 2016. These Regulations implement much of the EU Directive 2012/34, (the "Recast Directive"). In places, the regulations adopt the exact wording of the Recast Directive, but additional wording places it in context of the wider regulatory system in Britain, and also captures specific rules or interpretations made in UK legislation. The relevant section is reproduced as Figure 2.1. The words "market can bear" appear in subsection (3).

Key considerations lie in subsection (1) where the ORR is required to ensure that the charge, among other things, is not unduly discriminatory; in subsection (5) where the ORR is required to consider the distinctions listed in subsection (10); and in subsection (6) where the ORR is required to distinguish between franchise and non-franchise services.

2.2. Present mark-up charges and the situation of Open Access Operators

The Fixed Track Access Charge (FTAC) paid by franchised train operating companies (FTOC) and the FSC are existing mark-ups within the SoC. The reason that FTAC charges can be borne by the relevant market, even though many of the services do not earn fares sufficient to cover operating costs, is because potential contractors make financial bids to operate the services knowing what the charge is, and once settled Franchise Agreements protect them from most changes to it. More recently, and as noted in Section 1, mark-up were applied to rail freight operators, pursuant to a MCB test. These charges are specific to a particular freight market, precisely as implied by the term MCB.

Open access operators (OAO) do not currently pay mark-up charges: they pay only the variable track access charges, related to short-run costs and pass through costs. This includes the capacity charge.

A case was brought by GNER (GNER vs ORR (2006)) unsuccessfully challenging ORR's decision not to apply a mark-up beyond the standard variable charges to OAOs on the East Coast Main Line. In summary, it failed on a combination of grounds, including that applying different charges to franchised and open-access operators was not necessarily discriminatory in light of the lower risks that FTOCs face relative to those faced by open access operators.

Figure 2.1: Extract from The Railways (Access, Management and Licensing of Railway Undertakings) Regulations 2016, Schedule 3

2. – (1) In order to obtain full recovery of the costs incurred the infrastructure manager, with the approval of the Office of Rail and Road or, in relation to a rail link facility, the Secretary of state, may levy mark-ups on the basis of efficient, transparent and non-discriminatory principles, whilst guaranteeing optimum competitiveness, in particular in respect of rail market segments.

(2) For the purposes of this paragraph -

(a) the approval given by the secretary of state in relation to a rail link facility must be given through the development agreement; and

(b) approval given by the Office of rail and Road must -

(i) in relation to railway infrastructure subject to the access charges review, be given as part of that review; and

(ii) in relation to any other railway infrastructure, be given in such a form or manner as the Office may require.

(3) The effect of sub-paragraphs (1) and (2) must not be to exclude the use of infrastructure by market segments which can pay at least the cost that is directly incurred as a result of operating the railway service, plus a rate of return which the market can bear.

(4) The charging system must respect the productivity increases achieved by applicants.

(5) Before approving the levy of a mark-up under sub-paragraph (1) the Office of rail and Road or, as the case may be, the Secretary of state, must ensure that the infrastructure manager evaluates the relevance of the mark-up for the specific market segments, considering at least the pairs listed in sub-paragraph (10) and retaining the relevant one.

(6) The list of market segments to be considered by the infrastructure manager under sub-paragraph (5) must contain at least the three following segments: freight services, passenger services within a framework of a public service contract and other passenger services.

(7) In addition to the market segments consider under sub-paragraph (5), the infrastructure manager may consider further market segments according to commodity of passenger transported.

(8) Market segments in which railway undertakings are not currently operating but in which they may provide services during the period of validity of the charging system must also be defined; the infrastructure manager must not include a mark-up in the charging system for those market segments.

(9) The list of market segments must be published in the network statement and reviewed bat least every five years; the Office of Rail and Road must control that list in accordance with paragraph (2) of regulation 31.

(10) The pairs referred to in sub-paragraph (5) are:

(a) passenger versus freight services;

(b) trains carrying dangerous goods versus other freight trains;

(c) domestic versus international services;

(d) combined transport versus direct trains;

(e) urban or regional versus interurban passenger services;

(f) block trains versus single wagon load trains; and

(g) regular versus occasional train services.

2.3. Interactions with mark-up charges

Mark-up charges can interact with other financial flows, in the sense that these other flows may affect the ability to bear a mark-up charge, and the amount of money that can be raised by such a charge. Holding everything else constant, the FTAC, or else franchise payments applying to franchised operators, are likely to be adjusted in compensation for any new mark-up charge, and we consider those no further as in effect they are balancing charges.

Below we discuss a potential PSO Levy and the Capacity Charge, both financial flows that may affect both franchised and open access operators, and operate at the margin.

The Recast Directive empowers authorities that procure public transport services to make a levy on free market transport providers – in Great Britain that implies to open access operators – in compensation for any increase in the cost of the public service obligation (PSO) as a result of loss of revenue by the PSO providers. This is often referred to as a PSO Levy. As this is an option that the Directive provides there is no obligation to implement it in national law. UK law does not currently provide for it and legislation would be required for its implementation.

Additionally, a PSO Levy is not a track access charge, and any power to apply it would reside with transport funders, such as DfT, not ORR. If such a Levy were applied at some point, it could affect the magnitude of mark-up charge a TOC has the ability to bear. Although there has been mention of the possibility of applying such a PSO Levy in Britain, and a consultation from DfT on the principles for a PSO levy, we understand that it would be applied after the application of a mark-up track charge, and so in practice would not affect the ability to bear it. Rather, the application of a mark-up track charge applicable to open access operators would be a factor which might affect the requirement for a PSO Levy.

ORR has confirmed its intention to remove the present Capacity Charge in CP6. In many geographies, where TOCs earn lower revenue, the removal of this charge will mainly have the effect of reducing the amount of subsidy that a TOC is paid to operate those services, and would not open up or increase the ability to bear a mark-up charge. But in other geographies, which would in general include areas where OAOs operate, the removal of the charge could open up or increase the ability to bear a mark-up charge.

In the case of open access operators, the fact that they can bear to pay the Capacity Charge indicates that they have the ability to bear a mark-up of at least the scale of the present Capacity Charge, in the markets they currently operate in.

As we detail in Table 2.1, in 2015-16, open access operators Grand Central Trains and Hull Trains paid capacity charges amounting on average to around £0.50 per train mile in the latest available data.[9] OAO's Capacity Charge payment provides an indication of the **minimum** level of mark-up that could be afforded by existing OAOs on the East Coast Main Line, assuming the Capacity Charge is removed. Our analysis suggests that rather higher charges than these

[9] Both FTOCs and OAOs pay a Capacity Charge at a flat charge per train mile, differentiated by service code and with separate weekday and weekend rates. Since OAOs operate in their own specific service codes, the rates differ materially from FTOC rates on similar lines. OAOs in addition pay a "wash-up" capacity charge, which means that some OAO train miles attract a higher rate in the range of around £1 to £3 per train mile. Currently the OAOs' wash-up payment is small in comparison to their Capacity Charge, and £0.50 is a reasonable representation of what OAOs generally pay per train mile.

could be applied to unconstrained operators who run services of the nature identified (i.e. major intercity and outer commuter services).

Table 2.1: Open Access Operators' average capacity charge per train mile

Operator	Average capacity charge per train mile (2015-16)
Grand Central Trains	£0.51
Hull Trains	£0.47
East Coast Trains (for context)	£2.64

Sources: CEPA calculation based on ORR data of amounts paid and MOIRA mileage estimates – i.e. timetabled mileage.

2.4. Analysis of the potential for unitised mark-up charges for passenger services

As noted earlier, the FTAC is a mark-up charge, although not one that operates in a unitised way, such as a charge per train km or vehicle km. The application of mark-up charges to open access operators is likely to require a unitised charge, as is the case for the freight specific charge, so that it is proportional to use.

Relating a unitised track access charge to ability to bear is more complex in passenger markets than for freight markets. The fact that a mark-up is a track access charge means that it has to be charged in relation to the operation of trains on the track: it cannot, for example, be charged specifically on the people or goods carried, which would most directly capture the market. This distinction is more important for passenger than for freight.

As rail freight is largely operated today, individual freight trains generally haul a single commodity – assuming we treat containerised freight as a single commodity. Freight markets are strongly related to the commodity hauled. Predominantly freight priced off the railway transfers to road, which is a good substitute for many freight shippers.[10] This means that in freight the train and the market sector are closely related, and what the "market can bear" is clear; it rests on the potential for a charge to result in traffic of a particular commodity moving to road. We can therefore define freight market sectors according to the commodity they carry, and make a track charge on that basis. In practice this is what is done.

Our analysis of passenger services has been undertaken on the assumption that a mark-up would be levied per train mile. However, in a commercial analysis of passenger rail markets, we note that income is more closely related to passenger demand and journey purpose, not ignoring the importance of geography. If it were possible, there could be a better match between a mark-up charge and what the market can bear if the charge were based upon something related to passengers, particularly if done in a way that identified routes where trains run with a higher load factor and/or carry higher fare passengers.

[10] There are exceptions. The provision of coastal sea shipping is increasing, so in some cases freight might transfer to sea, at least for part of its trajectory. There are also cases where an increase in the price of delivered rail freight can reduce the quantity carried rather than transferring it to road.

This is supported by the observation that load management based ticketing systems are a profitable approach in many areas of rail markets, as opposed to setting fares for the train. These load management systems are clearly designed to differentiate prices by passenger characteristics rather than by train characteristics. The use of such yield management systems results in many trains carrying a mix of passengers, who have often paid a wide variety of different fares. Fares on the same train can vary between passengers by a large factor,[11] thus indicating that differences between passengers can be a large driver of ability to bear.

Unlike freight, we cannot as effectively identify the underlying passenger markets, which are a large factor in ability to bear, through charges on different trains. The main exception to this is in commuter markets. Here prices often are, in effect, set by train, identified by time of day, and the passengers using the higher priced, peak time, are dominated by commuters, who are largely all paying similar fares.

It is currently unclear whether it is practical or possible to make a mark-up charge, as a track access charge, based on passengers and passenger market sectors related to the different fares passengers pay. This report studies a mark-up charge based on train miles as a clear practical option for such a charge. But it is not as securely linked to the location of the underlying ability to bear the charge, as it would be if it were constructed on the basis by passenger market sectors. Our analysis involves a degree of averaging, which in turn results in a reduction in the amount that can be recovered by such a charge i.e. our work potentially produces conservative results which may underestimate ability to bear in some markets.

2.5. Project assumptions

It is not the role of this project to assess the form of charge for a mark-up charge, rather it considers whether conceptually there is an ability to bear and the scale of that. Nevertheless it is necessary to have some kind of an understanding of the possibilities in order to analyse the location of ability to bear. The way in which markets are segmented is also relevant to the form of the charge as is the need to consider what data Network Rail currently collects for charging purposes. Certain kinds of change and in some cases the handling of that change, can potentially require onerous and costly systems alterations. Charges that are based on data already collected are therefore easier to implement. In considering the form of charge, we take into the data what Network Rail already routinely collects.

In view of the broad range of possibilities for such a charge, and the potential interactions with other kinds of charging, ORR instructed us to make a number of assumptions, which are listed as follows. For clarity, these are assumptions solely for the purpose of simplifying this study; they are not intended to reflect ORR policy positions (although some might).

[11] For example, at time of writing I can obtain an Advance single ticket from London to Glasgow for a date a few weeks ahead for £30, but the Anytime Standard Class fare is £182.50.

Table 2.2: Assumptions ORR has instructed us to take

Area	Assumption
What is a franchised service? (core v. non-core)	For simplicity, assume all services run by franchised operators are the same (i.e. all 'core').
Shape of the charge and unit of traffic	The passenger mark-ups to be levied on train miles.
Scope of the charge in terms of services it can apply to	All passenger services (at this stage). The franchised services to be 'carved out' post technical analysis, with approach to levying charge (lump sum or incremental charge) to be determined by the ORR (policy decision).
Summer and sporting services	Do not treat separately, unless you have reasons to believe they have very different characteristics compared with the equivalent regular service, and you are able to model them without disproportionate effort.
Charter services	Treat separately but take a proportionate approach (e.g. by looking at a few services, their revenues and costs, including charges).
International services	Examine qualitatively to decide whether to include in analysis.
Assumption about capacity charge	No capacity charge in place for CP6 (all other charges at PR13 level).
Assumption about PSO levy	No PSO levy in place when undertaking MCB analysis.

In particular, we would note that we are instructed to assume no capacity charge, and any PSO levy would be supplementary to a mark-up charge determined without regard to the possibility of such a levy.

2.6. Non-discrimination

The current FTAC is a mark-up, which paid by franchised operators, who can bear it because of the nature of franchising. Precisely because franchised operators are subject to a franchise contract with a balancing payment to (or from) the department, and protection from changes in charges, an economist would not consider it unduly discriminatory that a franchised operator pays a FTAC, while an OAO does not.

From an economic perspective, the main issue of discrimination lies with the incentives different parties have to add or remove traffic at the margin, and the incentives to enter and exit the market. If all operators pay the same charges at the margin for entering the market, or for increasing their scope of operations, then in economics we would find there is no undue discrimination.

There are two arrangements which, from that economic perspective, would appear to create consistent incentives for OAOs and franchised operators in terms of adding or removing traffic:

- A unitised mark-up charge payable by all operators, according to relevant definitions of market sectors, or
- A unitised mark-up charge, according to relevant definitions of market sectors, is payable in respect of any service over and above the minimum service requirement of a franchise.

The first of these, which is the assumption we are instructed to take, is clearly the safest way from an economic perspective to avoid any risk of discrimination. Depending upon the level of the charge, it could have the potential to move a material proportion of the value in the FTAC to a new charge (we would expect the FTAC might be adjusted in consequence), putting aside changes resulting from cancelling the capacity charge.

The second of these would substantially narrow the scope of operation of the charge at the margin, with most of the mark-up levied as a lump sum.

For present purposes we are instructed to use the first assumption which simplifies the approach i.e. we assume a unitised mark-up charge payable by all operators, according to relevant definitions of market sectors.

2.7. Market sectors

2.7.1. Geographical market sectors

The most important market sectors for distinguishing the ability to bear of train services are likely to be geographic because the commercial potential of passenger services is likely to be highly specific to geography. So the main comparisons we make of the earning power of different services is between routes. We could attempt to describe services according to categories such as Intercity, but it seems likely that earning ability will vary substantially among such services and a commonly agreed definition of Intercity is hard to find.

Clearly it is practical to differentiate among trains by geography. Currently the Capacity Charge differentiates charge by service code. This is not the perfect basis, but it is what Network Rail is able to bill. In practice it is likely that a mark-up distinguishing geographical markets will need to be based upon service codes. As happens for other charges such as Schedule 8, service codes can in principle be adjusted if it facilitates a better market segmentation. Our analysis is therefore conducted at service code level.

2.7.2. Time market sectors

There are material differences in the earning ability of services according to time of day. This may also vary according to geography. Whilst we have a reasonably clear idea of what are peak and off-peak times for commuter services, valuable times of day may vary for other services. A uniform rigid definition is unlikely to work well for all relevant lines, and be counterproductive, but it is also likely to be difficult to devise workable localised definitions.

Our work therefore takes a practical approach. Network Rail has informed us that their track charging data recording methods do not enable them to distinguish miles travelled by time of day, although they can distinguish day of the week. In practice therefore it is currently likely to be impractical to operate a charge which makes a distinction by time of day. As a result, although we note their relevance, we do not consider time of day distinctions in our analysis.

2.7.3. Domestic and International Services

International services in the UK are currently confined, for all practical purposes, to the HS1 network.[12] Network Rail has practically no international services running on its network. HS1 and Channel Tunnel both charge under arrangements which attempt to recover their total costs. Access to the HS1 network and the Channel Tunnel are provided according to long-term contracts, which provide for charges considerably in excess of the short run operating costs. The legal basis of these charges differs from the mark-up provisions cited above, but clearly the effect of these charges on the operator is similar to a mark-up charge, in terms of reducing or exhausting the ability to bear an additional mark-up charge.

As there are currently no plans to extend international services further on the main line network, our work does not specifically consider them, as it is not useful to make a distinction at this point in time.

2.7.4. High speed services

Domestic high speed services make use of the HS1 network as well as the NR network but track access charges for HS1 domestic services are made under special arrangements and involve sums considerably in excess of the short-run operating costs which make a material contribution to HS1's total costs. Our work does not specifically consider high speed services further, given they only make limited use of the main line network (to connect from the high speed network to some destinations off it).

2.7.5. Charter services, special events, and other irregular trains

The market for charter trains is diverse, and little information is available on the costs and revenues associated with these services, so it is difficult to make a general statement concerning them. Extra trains operated for special events may in some cases be run as an obligation, e.g. the Olympic trains to Stratford, to limit the effect of a large additional temporary market on other services. In other cases they can be opportunity based. Typically such services serve distinctive markets and they are not marketed to the general rail traveller.

Overall such services do not amount to a material proportion of railway service provision: in its PR13 final determination the ORR stated that they represent less than 0.2% of total

[12] Eurostar trains make a very limited mileage on the NR network, generally outside normal operating conditions.

passenger (franchised and open access) mileage. Therefore, a solution that does not involve disproportionate effort is required.

If such services were to expand and be marketed to the general rail traveller, there would be a requirement to ensure equity of treatment. As things stand, it is an option to exclude such services from mark-up charges or treat them exactly as any other service, so that when the service does duplicate a train which would receive a mark-up charge, they also would pay it. The ORR would need to consider this further if a mark-up charge was determined.

We do not consider charter trains further in our analysis.

2.8. What does Market Can Bear mean?

We are applying a test as to whether individual markets can bear a charge. Therefore it is important to understand what is a market, and what it means that a market can bear a charge.

For our purposes, a simple definition of a market is all those services regarded as reasonably interchangeable or substitutable by the consumer.[13] Clearly this is a matter of degree, as some consumers would consider some services more substitutable than others.[14] A useful interpretation might be those services that can profitably be charged a price materially different from other services.[15] By these definitions there are potentially very many markets within the rail industry. In practice we are not able to describe markets at the most granular level, rather we describe them more broadly, which might arguably mean that they incorporate numerous sub-markets. We mainly consider trains serving different geographies, which will generally be separate markets. At the other extreme, it is a reasonable proposition that trains within about half an hour or so of each other on the same route cannot be securely considered to be in separate markets.

The simplest definition of what it means that a market can bear a charge is if that market can absorb or pass on that charge with relatively little impact on the level of demand in that market.

One complexity in applying this in the case of passenger rail markets is the risk of taking too narrow a view of what "being served" means. If service or fare adjustments are made in response to the charges, and the passenger chooses in consequence to travel by a different train, then the demand has still been served. This is different from rail freight, where the freight rarely has the choice to go on a different train under different conditions. Thus a freight train priced off the network is very similar to the freight it carries being priced off the network.

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[13] This is the same definition used in competition law.

[14] A trains an hour later, or a train tomorrow, or a train from the next station, or a train to a different destination, is a more acceptable substitute for some customers than others.

[15] Which is often the test used in practice to define markets for the purposes of competition law. It includes the possibility of both demand-side and supply-side substitution.

In the passenger market, it is not always clear that an increase in track charges would result in a change in the timetable and/or a change in fares. In particular, many train operators use the pricing flexibility that they have to maximise their ticket income,[16] given the timetable they are operating. However if suppliers did respond by reducing timetabled capacity, then some consequent fare adjustment is more likely where a greater proportion of travellers travel on unregulated fares, for example through the use of yield management systems. Where there is some adjustment either of timetable or fares or both, then some loss of demand is inevitable at the margin. Where train operators can manage demand to capacity with fares by yield management systems, such as intercity markets, the consequence will be a reduced availability of the cheapest tickets. Thus revenue might not be so much reduced as demand, as the train company will seek to retain the highest value passengers.[17] The proportionate response is to consider is demand in the form of the income that can be generated.

MCB can be indicated by the profitability of service providers, and testing for it in this way is relevant in this study, but it is not the only case. The existence of competition in the market means that the profit a monopoly provider could have earned in a non-competitive market is competed away to some extent. This commonly happens in the rail freight market. Ability to bear in such competitive markets lies with the ultimate customer for service, not necessarily the service provider. In a competitive market, in particular those with highly elastic supply, an additional charge would be passed through, at least in large part, to customers of the rail service.[18]

Similarly in rail passenger markets, where there are competing providers, ability to bear may lie in ability of the customers to pay higher fares. To the extent that competing providers are able to, they will pass on a mark-up charge to their customers. In this case, the real test may lie, as in freight, in the supply response of the operators.

For the majority of passenger rail services there is little direct competition, supply does not vary much, and the charge would largely be absorbed by the operator.[19] In such a case, the

[16] The proportion of demand paying unregulated fares varies considerably by geography.

[17] In technical terms, the train operators are able to manage these markets so that the elasticity of demand is close to 1, except in those markets where much of the demand is paying regulated fares. This is what we observe in reports of observed fares elasticities. Thus a test based on distinctions between elasticities of demand will tend not to identify useful differences between markets.

[18] In rail freight markets, supply is not necessarily elastic in the short run, due to nature of extended contracts in freight markets. Supply generally becomes more elastic in the longer run.

[19] When an additional charge or tax is placed upon a supplier, the extent to which a supplier finds it profitable to recover that from the customer can depend both upon the supply elasticity and the demand elasticity. When the elasticities are similar, the effect will be equal sharing. But, having noted that demand elasticities in rail tend to be moderate, then the effect of the supply elasticity will tend to dominate when it is either particularly high or particularly low, and the effect of the demand elasticity becomes important only in intermediate cases. For example when supply is completely inelastic, i.e., supply is fixed, that is a sufficient condition for the supplier to take the entire impact of the charge. The supplier is already maximising revenue for the present level of supply, to the extent that fares regulation permits, and a change in cost conditions does not change the revenue maximising fares, and supply cannot be altered. Similarly when supply is completely elastic, a description of a

main criterion of ability to bear is likely to lie in a substantial operating surplus, before adjustment for franchise payments and FTAC. In our analysis we measure this operating surplus in the form of net passenger revenue, i.e. passenger revenue less the main operating cost, as described below.

In the first stage of this project, we examine operating surpluses of railway services, bearing in mind that this can be misleading as a measure of ability to bear where there is material competition. In the second stage, we consider the potential of a charge to deter the operation of trains. Since trains operate in "diagrams", i.e., the full set of movements of a train during the day, we identify the relatively less profitable diagrams within the overall service, and consider what level of charge would deter the operation of those diagrams. We explore two ways of looking at this, a monopolistic approach and a competitive approach. Both tests are an attempt to ask a similar question to the elasticity approach used in freight – what level of charge would deter the operation of trains. These two stages are described in the following chapters.

perfectly competitive market, that is a sufficient condition for the charge to be completely passed on to the customer. Clearly these are theoretically extreme cases, but they illustrate that the effect of supply elasticity dominates both when supply is fixed and when the market is sufficiently competitive. The services we are referring to at this point of the text are the lower revenue services where supply is substantially determined by the franchise contract, and there is small possibility of earning profit by expanding supply. Thus supply in these cases is highly inelastic, and the conclusion is that the supplier will largely take the impact of a new charge.

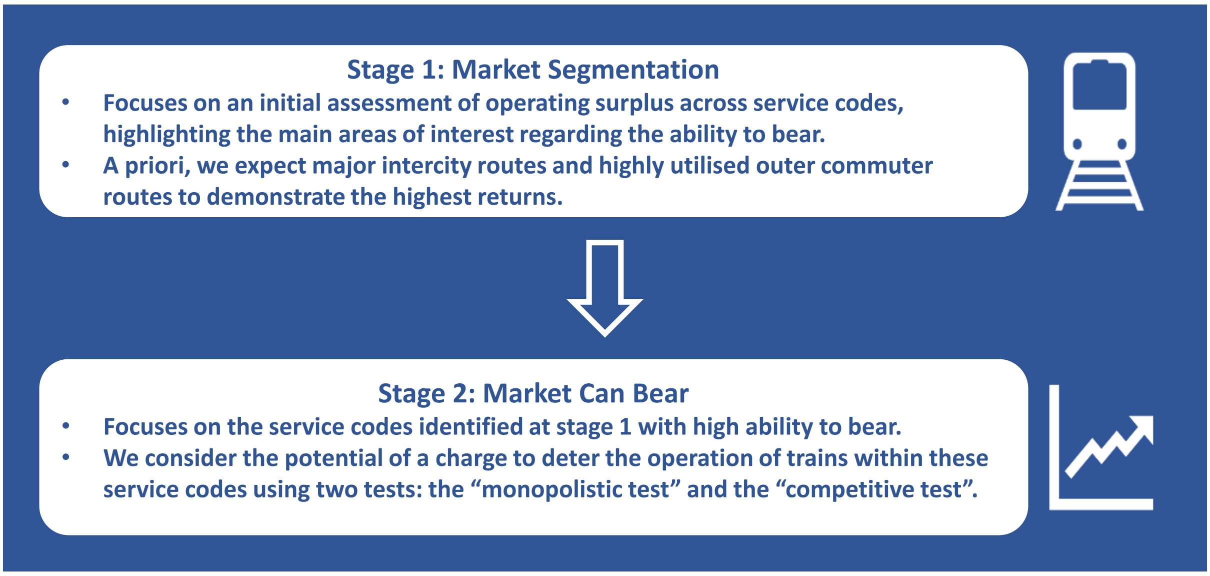
3. HIGH LEVEL APPROACH AND DATA SOURCES

3.1. Overview

We undertook our analysis in two stages. The first stage takes a simplified approach to the whole GB rail market in order to locate where ability to bear might lie and allow us to focus on those locations in the second stage of work. The second stage comprises case studies that try to test in more detail the ability to bear within a given service code.

Our approach is summarised in the figure below.

Figure 3.1: Overview of approach



3.2. Data sources and manipulation

A number of different data sources were used within the analysis:

- Revenue and costs at a TOC level were sourced from the ORR's February 2017 publication "UK Rail Industry Financial Information 2015-16".[20]
- Revenue at a service code level were obtained through the rail industry's MOIRA model, which is commonly used to forecast the impact of timetable changes on demand and revenue. We used the national, all operators version of MOIRA1.[21]
- MOIRA also provided train miles and service type (i.e. intercity, commuter or other) at a service code level. Train miles at a service code level were aggregated to obtain train miles at a TOC level, and the most common service type for each TOC was selected to obtain service type at a TOC level.

[20] Source: http://www.orr.gov.uk/__data/assets/excel_doc/0012/24150/uk-rail-industry-financial-information-2015-16.xlsx

[21] As a demonstration, we additionally used MOIRA2 for some service codes. This indicates that the national version of MOIRA1 may be too approximate in some cases.

- Supplementary service code level data on train miles, vehicle miles, capacity charge rates, and power type were obtained directly from Network Rail. Similarly, TOC level train miles, vehicle miles and capacity charge rates were obtained by aggregating service code level data. The most common power type for each TOC was selected to obtain power type at a TOC level.

The data sources used are summarised in the table below.[22]

Table 3.1: Data sources

Data Type	Source
TOC Level Data	
Revenue	ORR.[23]
Costs	ORR.[24]
Fixed Track Access Charges	Network Rail.[25]
Train Miles	Aggregated from MOIRA1 service code level data.
Vehicle Miles	Aggregated from ORR service code level data.
Service Type	Most common service type within MOIRA1 service type data.
Power Type	Most common power type within Network Rail power type data.
Capacity Charge	Aggregated from Network Rail service code level data.[26]
Service Code Data	
Revenue	MOIRA1, national all operators version.
Costs	Estimated using a linear cost model for each cost category. Calibrated using the ratio between the estimated costs at a TOC level and ORR published costs at a TOC level for each cost category.

[22] All cost and revenue data was converted to a 2015/16 price base using the Office of National Statistics (ONS) all items retail price index (RPI) to ensure all data was on comparable terms. We use RPI rather than other inflation indices because this is the index commonly used for rail fare adjustments and access charge regulation.

[23] Source: http://www.orr.gov.uk/__data/assets/excel_doc/0012/24150/uk-rail-industry-financial-information-2015-16.xlsx

[24] Source: http://www.orr.gov.uk/__data/assets/excel_doc/0012/24150/uk-rail-industry-financial-information-2015-16.xlsx

[25] Source: https://16cbgt3sbwr8204sf92da3xxc5m-wpengine.netdna-ssl.com/wp-content/uploads/2016/12/Schedule-of-Fixed-Charges.xls

[26] Capacity charges are provided at a 8-digit service code level, and there are separate rates for weekdays and weekends. We have constructed an overall daily capacity charge rate for each 8-digit service code by multiplying the weekday rate by 5/7 and the weekend rate by 2/7. For the purpose of this analysis we have then aggregated service codes up to a 4-digit service code level by averaging the capacity charge rates across the 8-digit service codes that are contained within each aggregated 4-digit service code. The average capacity charge rate for each 4-digit service code is then multiplied by the total train miles for that service code to obtain an estimate for capacity charge payments for each relevant 4-digit service code in 2015-16. For open access operators, we also need to calculate an estimate of the wash-up rate payment for each service code, and for this reason we calculate capacity charge payments for the OAOs at a 8-digit service code level. Source: https://www.networkrail.co.uk/industry-commercial-partners/information-operating-companies/cp5-access-charges/

Data Type	Source
TOC Level Data	
Train Miles	MOIRA1.[27]
Vehicle Miles	Provided by ORR, which we adjusted by the ratio between MOIRA and ORR train miles to obtain a MOIRA vehicle miles estimate. The latter was used to estimate service code level costs.
Power Type	Network Rail (sourced directly).
Service Type	MOIRA1.
Capacity Charge Rates	Network Rail.[28]

To enable to consolidation of Network Rail/ORR and MOIRA data it was necessary to match the service codes. However, National Rail/ORR uses an 8-digit service code format whilst MOIRA uses a shortened 4-digit service code format. To overcome this issue we attempted to match the service codes at a 4-digit level but found compatibility issues with a number of service codes. As a result, Network Rail/ORR and MOIRA service code level data was matched using the first 3-digits of the service code, and service codes were aggregated into small groups where necessary to enable a match. The consequence of this necessary action is that we lose a degree of granularity within the analysis, but we do not consider this has a detrimental impact on the overall outcome. This is because most service codes are in practice fully defined at 3-digit level, and most of the issues with 4-digit codes occurred in areas of the network of relatively low revenue.

[27] Train mile data was also supplied by Network Rail (directly) but we have used MOIRA train mile data when calculating "per train mile" indices within our analysis, for consistency, and in particular to ensure that the miles are not less than are necessary to operate the timetable. However, MOIRA vehicle miles were estimated by adjusting Network Rail vehicle miles by the ratio between MOIRA train miles and ORR train miles, to provide for the empty stock movements that MOIRA does not account for.

[28] Source: https://16cbgt3sbwr8204sf92da3xxc5m-wpengine.netdna-ssl.com/wp-content/uploads/2016/12/List-of-Capacity-Charge-Rates.xls

4. STAGE 1

Stage 1 of the analysis focused on an initial simple assessment of the likely ability to bear across all services codes. We carried out this stage of the analysis using the data sources above, which we used to calculate net revenue per train mile (or operating surplus per train mile) at a TOC level and at a service code level. The results of this analysis enabled us to see where there is likely to be a high ability to bear.

The subsections below discuss our approach to calculating net revenue per train mile at a TOC level and at a service code level. All calculations are done per train mile because the basic assumption is that the charge will be levied per train mile.

4.1. TOC level analysis

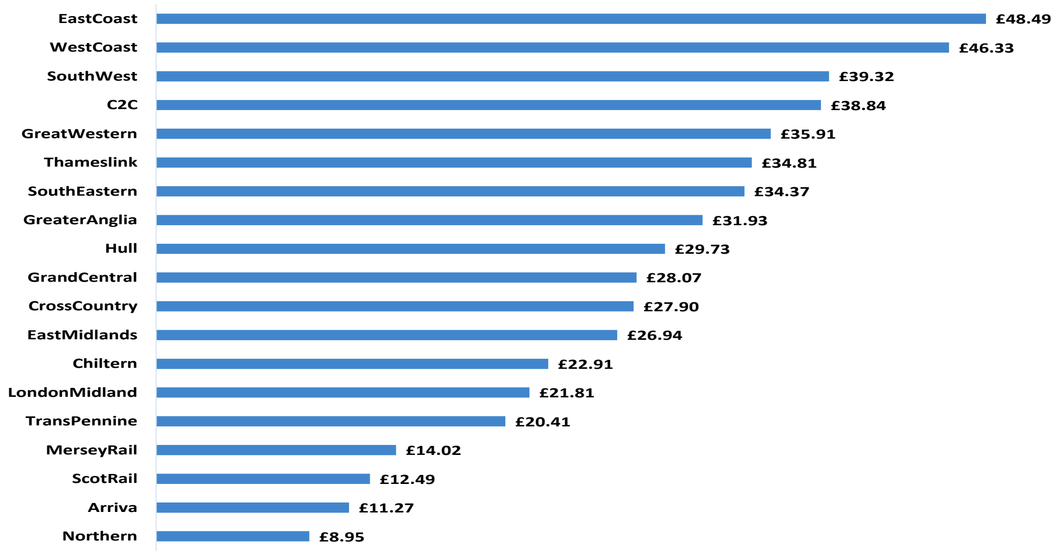
The sections below present TOC level revenue, costs and net revenue analysis. While our Stage 2 analysis is informed by service code data, we conducted TOC level analysis in this first stage because the data sources were public. While we recognise that services run by each TOC are varied, this analysis provides an initial indication of profitability at TOC level, allowing us to identify, at a high level routes, with ability to bear which are then considered in more detail in Stage 2.

4.1.1. Revenue

ORR published revenues and costs of FTOCs and OAOs in its February 2017 publication "UK Rail Industry Financial Information 2015/16". We use this data set in our Stage 1 analysis. For FTOCs, total revenue is made up of passenger revenue, other revenue and government funding. OAOs revenue stream consists of passenger revenue and other revenue. Other revenue is created by providing services such as station parking and on-train refreshments.

However, for the purpose of this study, we deemed it appropriate to calibrate to passenger revenue only as this improves comparison between different TOCs and to MOIRA service code level revenue which only considers passenger income. The figure below presents passenger revenue per train mile for each TOC, based on published ORR revenue data (as mentioned above) and train miles for the 2015/16 financial year.

Figure 4.1: Passenger revenue per train mile – TOC level



Source: CEPA analysis using published ORR data.

Passenger revenue per train mile ranges from £9 (Northern) to £48 (East Coast). An assessment of the ability to bear based on gross passenger revenue per mile would suggest that East Coast and (second in the list) West Coast are likely to have a relatively higher ability to bear compared with other TOCs. This is perhaps as expected given that these TOCs largely serve major intercity routes between London and other large UK cities like Birmingham, Leeds, Newcastle and Edinburgh. However this is too coarse an analysis – Great Western for example is made up of regional and commuter services as well as the intercity services similar to those provided by East Coast and West Coast. Figure 4.1 also indicates substantial income in certain commuter TOCs serving London.

4.1.2. Costs

In considering the costs of train operators, we make a number of exclusions which are described below:

- Capacity charge – ORR has decided this charge will no longer apply from CP6;
- Fixed track access charge – this is a contribution to Network Rail's fixed costs out of the surplus which this study seeks to identify, and is in essence a balancing figure;
- Payments to/from government – these are franchise payments which are bid in knowledge of the size of the FTAC. We wish to understand the underlying ability to bear before TOCs bid this payment/subsidy.

For clarity, the variable usage charge[29] remains part of the costs of the operator.

[29] For avoidance of doubt, all access charges, aside from those specifically mentioned in the previous bullets as excluded, remain part of the costs of the operator.

ORR's published cost data also highlights differences between FTOCs and OAOs as indicated in Table 4.1 below.

Table 4.1: ORR published cost categories

FTOC	OAO
Staff	Staff
Fuel - diesel	Fuel
Traction electricity	Rolling Stock
Rolling stock	Network Rail Charges
Payments to government	Other expenditure
Corporation tax	
Other including Network Rail charges	

For comparison purposes, cost categories at the disaggregate level were combined so that FTOCs and OAOs costs were split into the same four cost types: staff, fuel, rolling stock and other costs. For the purpose of this study we name these "middle-up" costs. This data consolidation process is presented in the table below.

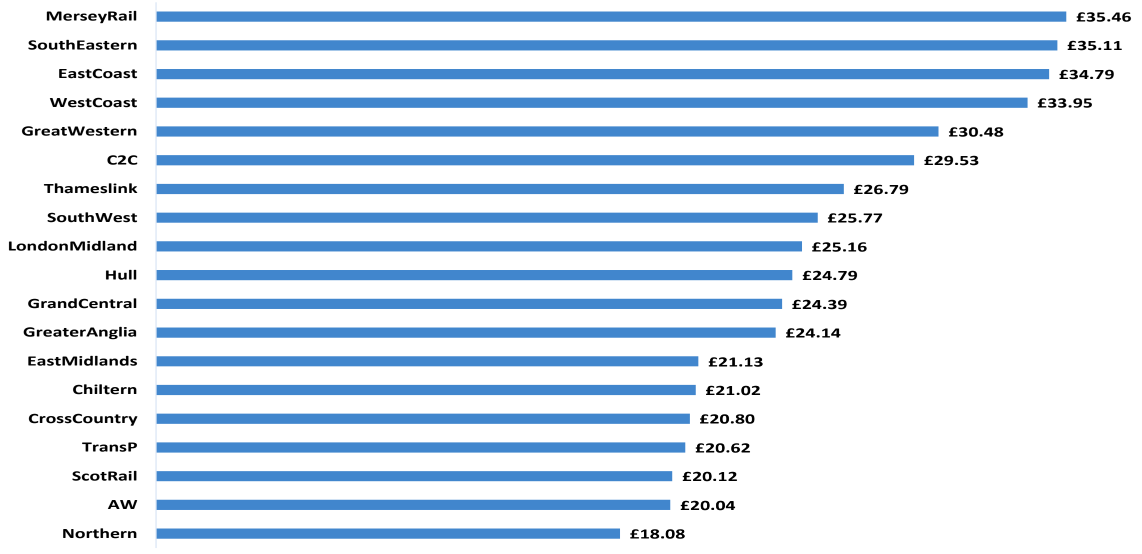
Table 4.2: Cost data consolidation

<table>
<tr><th rowspan="2">Middle-up</th><th colspan="2">Disaggregated cost categories</th></tr>
<tr><th>FTOCs</th><th>OAOs</th></tr>
<tr><td>Staff</td><td>• Staff</td><td>• Staff</td></tr>
<tr><td>Fuel</td><td>• Fuel – diesel
• Traction electricity</td><td>• Fuel</td></tr>
<tr><td>Rolling stock</td><td>• Rolling stock</td><td>• Rolling Stock</td></tr>
<tr><td>Other</td><td>• Payments to government
• Corporation tax
• Other including Network Rail Charges</td><td>• Network Rail Charges
• Other expenditure</td></tr>
<tr><td>Costs excluded from analysis</td><td>• Capacity charge
• Fixed tracked access charge
• Payments to / from government</td><td>• Capacity charge, which includes a wash-up rate</td></tr>
</table>

Total costs for FTOCs and OAOs are the sum of staff, fuel, rolling stock and other costs. It is however appropriate and necessary to make the exclusions mentioned above, so that we are able to properly assess what level of charges each market can bear before these adjustments occur.[30] This approach also ensures costs are comparable between FTOCs and OAOs given that OAOs do not incur costs associated with the FTAC and government payments.

The figure below presents total costs per train mile for each TOC, based on the above assumptions and using published ORR cost data and train miles for the 2015/16 financial year.

Figure 4.2: Total costs per train mile – TOC level



Source: CEPA analysis using published ORR data

Total costs per train mile range from £18 (Northern) to £35 (Mersey Rail).

4.1.3. Net passenger revenue

Based on the costs and revenues derived from the above, Figure 4.3 (below) presents net passenger revenue per train mile for each TOC, where net revenue is calculated as passenger revenue (Figure 4.1) minus total costs (Figure 4.2), subject to the exclusions we have made. In summary the calculation is as follows:

Net revenue equals:

Passenger revenue – staff costs – fuel costs – rolling stock costs – other costs.

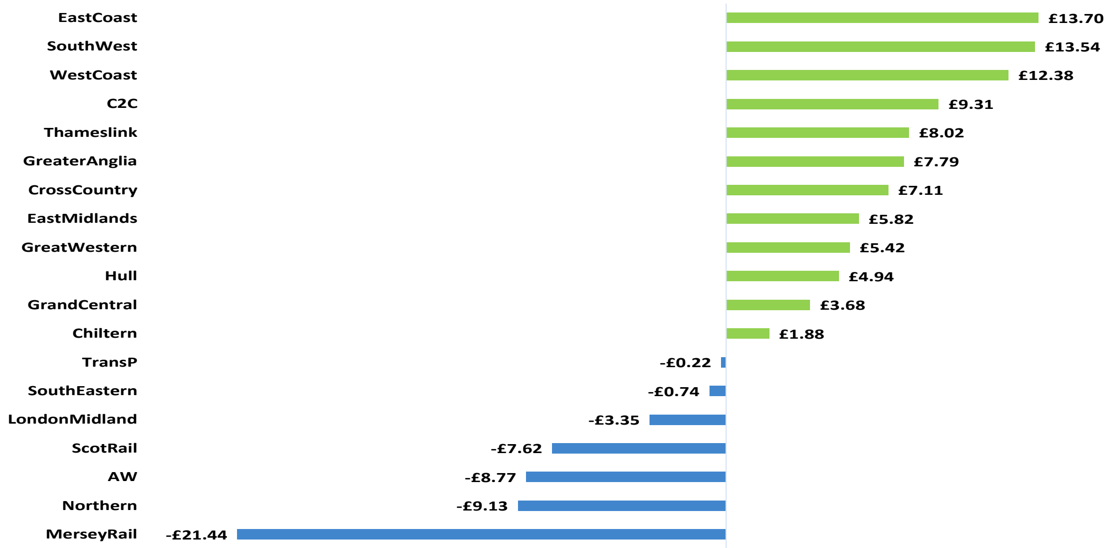
Where

- ***"other costs" includes the variable usage access charge, but excludes the fixed track access charge, capacity charge, or government transfers; and***

"passenger revenue" excludes any government transfers. .

[30] The capacity charge includes a wash-up rate for OAOs in CP5.

Figure 4.3: Net revenue per train mile – TOC level



Source: CEPA analysis using published ORR data

Note: The net revenue measure is based on passenger revenue only, and the net deductions are before capacity charge, FTAC and government transfers.

Figure 4.3 highlights that net revenue per mile varies considerably across TOCs. At a whole TOC level, East Coast generates the largest net revenue per train mile at approximately £14 per train mile. Several TOCs operate at a negative net passenger revenue level, with Merseyrail having a net revenue of –£21 pre train mile being the most negative.

4.2. Service code level analysis

In the previous section we explored the financial information of TOCs at an overall level using published ORR data for the 2015/16 financial year. We also examined company financial information at a service code level. This is of interest because geographic markets are likely to perform very differently, including within individual TOCs; we would expect major intercity routes and highly utilised commuter routes to earn the highest returns. Overall, making an weighted average across service codes, the average revenue per train mile is about £29; the average cost per train mile is about £26; and the average net revenue is about £3.[31]

4.2.1. Revenue

Revenue data at the service code level was obtained from MOIRA1, which provides passenger revenue generated from each individual service code within a TOC. However, as MOIRA does not include economic factors such as income and employment which have a strong effect on

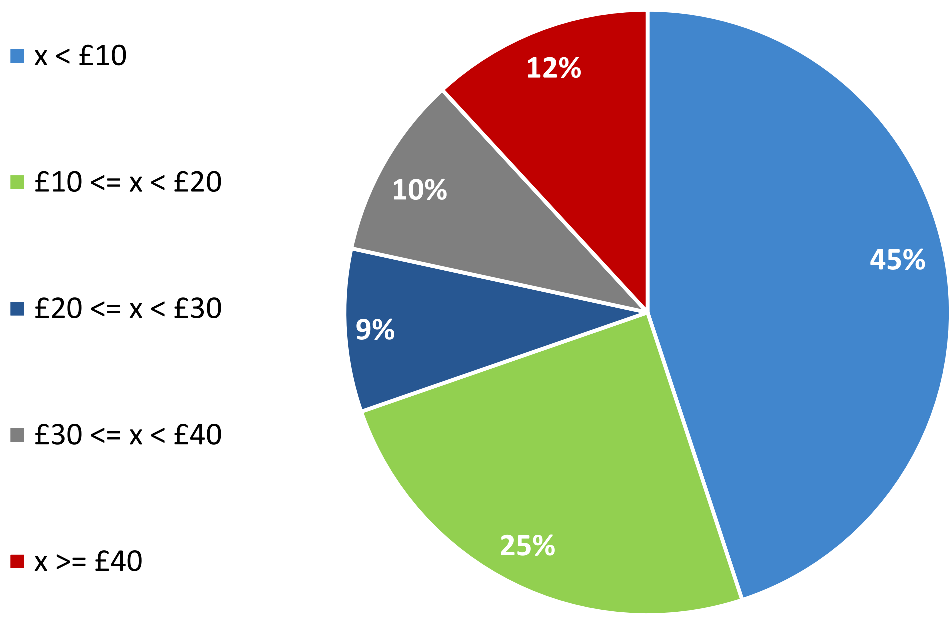
[31] The average metrics presented in the main text are weighted averages, taking the total revenue, cost and net revenue per train mile of the industry. However these weighted averages are affected by a minority of more profitable service codes. The unweighted averages are average revenue per train mile £17; average cost per train mile is £23; and average net revenue per train mile of –£5 (figures do not add due to rounding).

revenue, it is necessary to calibrate MOIRA outputs against known TOC incomes. MOIRA revenue was recalibrated using an adjustment factor based on the ratio between MOIRA revenue and TOC passenger revenue as reported by ORR,[32] which ensured that the sum of revenue at service code level was equal to ORR passenger revenue at a TOC level. The revenue and cost adjustment factors used for this analysis are presented in Annex A to protect data confidentiality.

We were using National MOIRA for its complete coverage, and to facilitate a uniform approach. However, National MOIRA has difficulties with shorter London commuter routes due to station aggregation into zones. In the case of four service codes with particularly implausible results, and which we had expected could be of interest, we ran MOIRA2 to obtain better outputs. However this is much more onerous, and we have not extended it to the rest of the London commuter area.

The figure below presents the proportion of service codes by passenger revenue per train mile.

Figure 4.4: Proportion of service codes by passenger revenue per train mile



Source: CEPA analysis

The majority of service codes earn passenger revenue of less than £20 per train mile (70%). Given that average cost per train mile is about £23 this suggests that the majority of service codes, based on passenger revenue only, earn negative net revenue overall. On the other hand, 22% of service codes earn passenger revenue per train mile greater than £30, which suggests that there are likely to be a significant number of services that have the ability to bear charges at some level, which we explore further in Stage 2. It should be noted that some

[32] Source: http://www.orr.gov.uk/__data/assets/excel_doc/0012/24150/uk-rail-industry-financial-information-2015-16.xlsx

service codes cover a much greater proportion of passenger demand than others, and some of the most valuable service codes, for example intercity codes, are some of the largest.

4.2.2. Costs

Whilst revenue data can obtained at a service code level, cost data is only available at a TOC level. It was necessary therefore to estimate costs at a service code level (to capture the fact that costs may differ between different types of services) in order to allocate them. We did this using regression analysis to estimate unit costs. This process involved estimating simple linear cost functions for each cost type - staff costs, fuel costs, rolling stock and other costs – using TOC level data. The estimated model parameters and characteristics of each service code were then used to obtain predicted costs for each service code. The predicted costs from each of the four individual cost models were then summed, and calibrated at a TOC level to ensure that the sum of service code level costs for each TOC was equal to ORR total costs at the TOC level.

The data sources used for this exercise include:

- TOC level data on costs from the ORR.
- Service code level data on train / journey miles, aggregated to a TOC level.
- Service code level data on service type and power type from MOIRA.

The most significant drivers of costs identified as part of this study were:

- Train miles.
- Vehicle miles.
- Service type (intercity, commuter and other).
- Power type (electricity and diesel).

While TOC level data on train miles and vehicle miles was available, data on service type and power type varied by service code; some service codes include a mix of service types and power types. As a first step, it was necessary to make a simplified assumption on the most common service and power type for each service code. The most common service type and power type for each service code were used for the purpose of allocating costs across service codes. The quantity of train and vehicle miles by each service type and power type could then be aggregated for each TOC to regress against the known costs. Specifically, a set of three dummy variables was then created to indicate the service type and power type of a particular TOC:

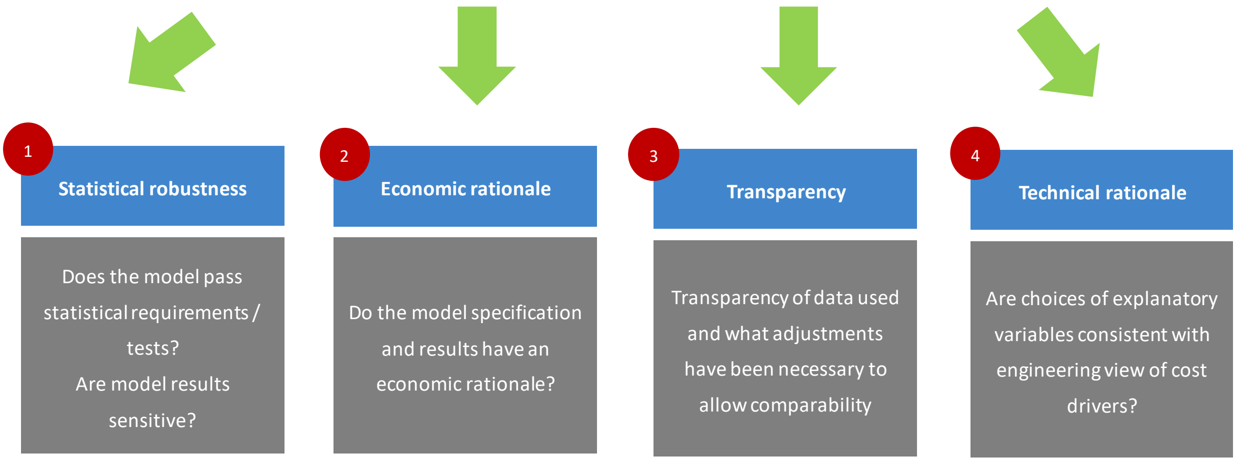
- **Diesel dummy variable**: equal to 1 when the power type is diesel; zero otherwise.
- **Intercity dummy variable**: equal to 1 when the service type is intercity; zero otherwise.

- **Commuter dummy variable**: equal to 1 when the service type is commuter; zero otherwise.

The dummy variables were interacted with either train miles or vehicle miles, depending on whether train miles or vehicle miles were deemed the most appropriate to use as the main driver of a particular set of costs e.g. fuel.

The second step of this analysis involved developing simple linear cost functions to estimate the level of costs for each service code. The model selection process used for this study was centred around four pillars, used to assess the appropriateness of the estimated cost function for the purpose of estimating service code level costs, as summarised in the figure below.

Figure 4.5: Model selection process



Through this process we arrived at the following model specifications for each respective cost type. While we did test a "top-down" total cost model as part of the selection process, the model estimation results indicated that it was more appropriate to estimate costs at a disaggregated cost type level. It is then possible to select the most appropriate cost drivers for each cost type. The table below presents the selected model specifications for each respective cost type. While power type was found to be a significant driver of fuel and other costs, it was not considered to be a significant driver of staff and rolling stock costs. Similarly, train miles was found to be a more appropriate driver of staff costs but vehicle miles was considered a more appropriate driver of fuel, rolling stock and other costs.

Table 4.3: Components used within each cost category regression

Cost category	Train Miles	Vehicle Miles	Train Miles* Commuter	Train Miles* Intercity	Vehicle Miles* Diesel	Vehicle Miles* Commuter	Vehicle Miles* Intercity
Staff	✓		✓	✓			
Fuel		✓			✓	✓	✓
Rolling Stock		✓				✓	✓
Other		✓			✓	✓	✓

The inclusion of the diesel interaction variable, attempts to estimate the marginal effect on costs of being power type 'diesel' relative to 'electric'. Similarly, the commuter and intercity interaction variables estimate the marginal effect on costs of being service type 'commuter' or 'intercity' relative to 'other'.

The model estimation results for each of the four models are presented in the table below. An intercept was not included in any of the models as we needed to unitise all costs.

Table 4.4: Model estimation results.

Independent (explanatory) Variable	Dependent variable			
	Staff Costs	Fuel Costs	Rolling Stock Costs	Other costs
Train Miles	7.94***			
Train Miles × Commuter	2.61*			
Train Miles × Intercity	0.28			
Vehicle Miles		0.36***	1.20***	1.63***
Vehicle Miles × Diesel		0.16***		0.27
Vehicle Miles × Commuter		-0.11*	-0.38**	0.54
Vehicle Miles × Intercity		-0.18***	-0.85***	-0.32
Number of observations	19	19	19	19
R^2	0.96	0.98	0.96	0.95

A number of the explanatory variables in the models are statistically insignificant but we consider it appropriate to include them given that the technical justification for their inclusion is clear, and the sign and magnitude of the estimated coefficients are sensible. Overall, the explanatory power of the models, indicated by R^2, is very high, which provided further evidence that the chosen model specifications were appropriate.

The predicted costs from each of the four cost type models (i.e. staff, fuel, rolling stock and other) were obtained at a service code level using the parameter estimates and characteristics of each service code. The predicted costs from each cost type model were then calibrated at a TOC level to ensure that the sum of service code level costs for each TOC was equal to ORR costs at the TOC level. A fictional example for staff costs is presented below for illustrative purposes, taking the same approach as was taken for all four cost types in our analysis.

Table 4.5: The process of obtaining the predicted costs from the staff costs model

	Train Miles	Train Miles x Commuter	Train Miles x Intercity
Estimated coefficient	7.94	2.61	0.28
Explanatory Variable	7,500,000	0	7,500,000

	Train Miles	Train Miles x Commuter	Train Miles x Intercity
Estimated coefficient x explanatory variable	59,550,000	0	2,100,000
Predicted staff costs	£59.550 million + £0 + £2.100 million = £61.600 million		
Adjustment factor	0.80		
Calibrated predicted staff costs	£61.600 million / 0.8 = £77.000 million		

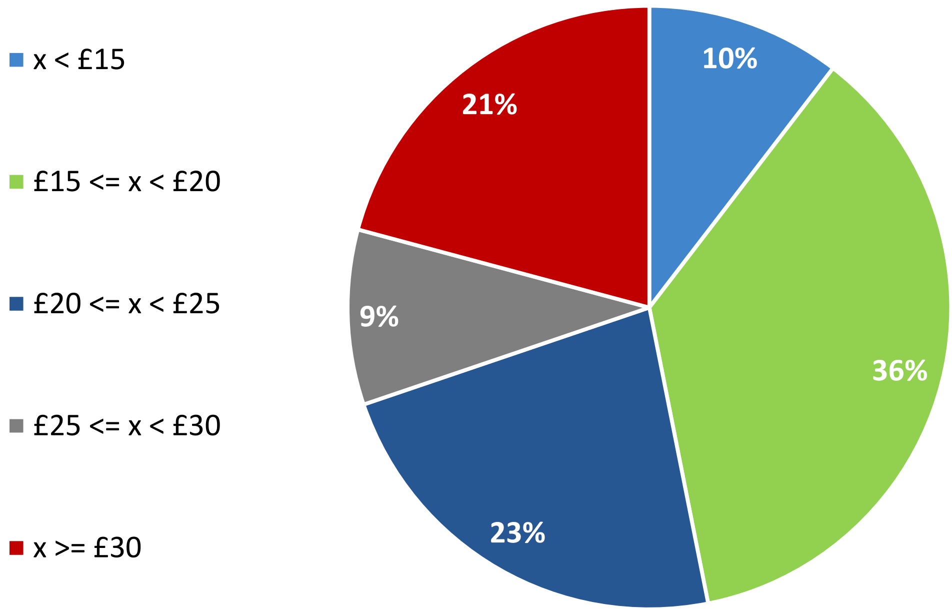
Calibrated staff, fuel, rolling stock and other costs were subsequently summed to obtain calibrated level of total costs for each service code. We have found that the predicted costs for each service code, obtained using the above cost functions, are very sensitive to the number of vehicles per train. A change in train length by 1 car typically changes costs by around £2 - £3 per train mile. For the Stage 2 analysis, we have set the number of vehicles per train to the average for each service code.[33] In reality individual services would run with specific numbers of vehicles rather than this average. In the absence of detailed data on stock formations we need to take a pragmatic approach, and the advantage of this is it ensures costs are in line with those found in Stage 1. This means that there is a degree of uncertainty in the net revenue of each diagram, both due to the simplified cost approach and the uncertainty over what stock formation would be most appropriate.[34]

The figure below presents the proportion of service codes by total cost per train mile.

[33] Based on ORR data.

[34] FTOCs may be funded to extend train formations to reduce crowding, whereas OAOs are more likely to choose stock formations on commercial criteria.

Figure 4.6: Proportion of service codes by cost per train mile



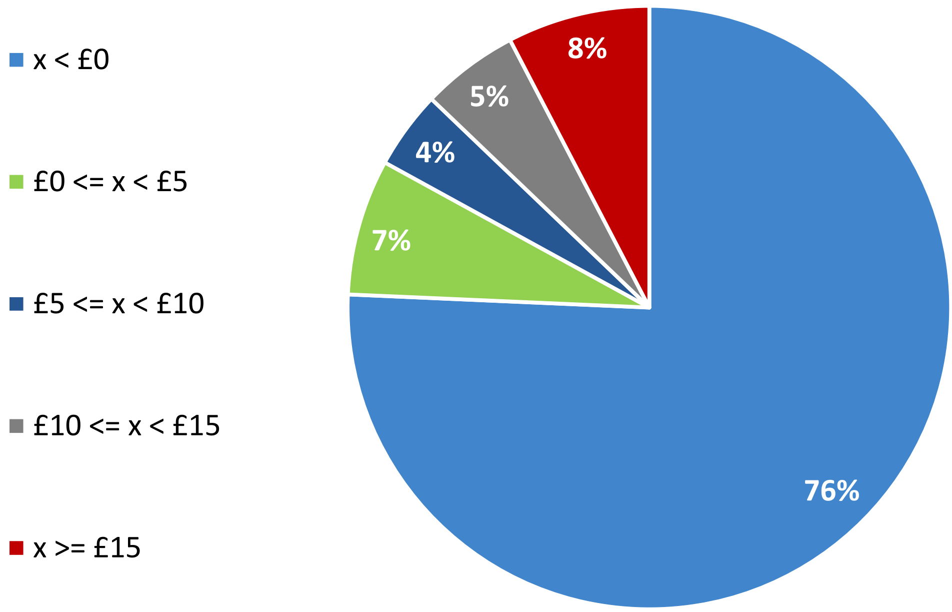
Source: CEPA analysis

According to our cost estimation methodology, a large proportion of service codes (53%) incur costs over £20 per train mile. Given that average revenue per mile across service codes is about £17 per train mile, this indicates that a large proportion of service codes earn negative net revenue per train mile (based on passenger revenue only). At the same time, however, a significant proportion of service codes incur costs below £15 per train mile (10%). This suggests that there is likely to be a significant number of service codes that have the ability to bear charges at some level, which we explore more thoroughly in Stage 2, i.e. major intercity and highly utilised commuter routes.

4.2.3. Net revenue

The cost and revenue modelling at a service code level, as outlined above, can be used to calculate net revenue per train mile for each service code. The figure presents the proportion of service codes by net revenue per train mile.

Figure 4.7: Proportion of service codes by net revenue per train mile



Source: CEPA analysis

The figure above shows that the majority of service codes, when only considering passenger revenue, operate on a net revenue deficit (76%). However, there remains a significant proportion of services that operate on a net revenue surplus in excess of £5 per train mile (17%), which is greater than the current average capacity charge across service codes (this is approximately £1.35 per train mile). It is also important to consider that certain service codes may not exhibit high operating surpluses due to the presence of competition. Competition may be holding prices down, and in fact these service codes may be able to bear charges without causing a significant change in the level of service being provided to core customers.

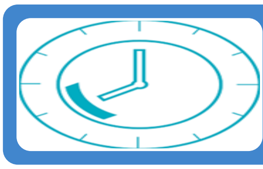
Through the analysis of net revenue at a service code level we were also able to identify particular market sectors of service whereby a material ability to bear higher charges could exist, bearing in mind that our sectors need to be practical for a train-mile based charge. By consideration of where OAOs are willing to operate, and at what levels of net revenue per train mile, is likely that the focus for charging a mark-up will mainly be in service codes with a net revenue above what OAOs earn. A complication, noted previously, is that current service codes can contain a mixture of more and less remunerative services.

Our sector analysis showed that geographic and time of day/week markets are the primary interest of this study, as summarised in the figure below.

Figure 4.8: Market sectors

Geographic markets

- Are the main market distinction that requires study.
- The ability of different rail routes to bear charges varies substantially in a way that cannot be otherwise 'proxied'.



Time of day/week markets

- Also a major driver of ability to bear.
- Commuter-dominated lines have predictable valuable times but other lines can vary.

International services

- Operate entirely on HS1 for the forseeable future, and thus do not affect Network Rail charging.

By assessing the net revenue by service code we were able to identify the service codes that earn the highest net revenues. As expected, this assessment highlighted that the highest net revenues are achieved on:

- **Major intercity routes** – for example, services between London and other large UK cities like Birmingham, Manchester, Leeds and Liverpool.
- **Highly utilised, outer commuter routes** – for example, services between London and Colchester, Southampton and Cambridge.

At the same time, a number of difficulties arose in this stage of the analysis:

- In the London Commuter area, National MOIRA is not very reliable for the inner commuter zone because of station aggregation issues, and also extensive line overlaps in the south London area.[35] Some of the results obtained may be highly distorted in this zone. In order to avoid this issue and in a limited number of cases we substituted the analysis with MOIRA2, which resulted in much more plausible results for those codes. This indicates a requirement for a more detailed consideration of the London commuter zone if an MCB based charge is proceeded with.
- Even at service code level, certain codes include a mix of services, some of which are likely to be of more valuable. For example, both the main service to a major town, and some shorter distance services and/or a stopping service calling at lightly used stations on the same line may be included in a particular service code. Our approach does not separate out all relevant service differences.

[35] National MOIRA does not treat each station individually, rather it groups them geographically. Generally each major station would be in a separate group, and this is a reasonable approximation in many cases. However in London the distortion from doing this is larger, because nearby stations can be individually much more important in terms of demand and routing. It thus distorts the modelling of the selection of journeys that customers make, resulting in substantial mis-estimation of the distribution of revenues among overlapping service codes.

In a few cases where one might have expected a valuable service geography to emerge, but it did not, at least one of the above issues was present.

4.3. Next steps

Stage 1 analysis highlighted the main areas of interest regarding ability to bear, with major intercity routes and commuter routes demonstrating the highest returns. At the same time, we identified that certain service codes may not exhibit high surpluses due to prices being kept down by competition. Overall, the consistent message that came out of the Stage 1 analysis was that the true nature of ability to bear lies in services at the margin, i.e. the least profitable services within a service code. Thus, we considered it appropriate to focus Stage 2 analysis on assessing the impact of an increase in charges at the margin, i.e. what level of charge would deter the operation of services at the margin. Taking this on board, the Stage 2 approach and findings are outlined in Section 5.

5. STAGE 2

The essence of a MCB approach is to consider the potential of a charge to deter the operation of trains. Since trains operate in "diagrams", i.e., the full set of movements of a train during the day, we consider the marginal unit to be a complete diagram rather than a train movement. In principle we identify the relatively less profitable diagrams within the overall service, and consider what level of charge would deter the operation of those diagrams.

We have explored two ways of looking at this, what we call a monopolistic approach and a competitive approach. Both tests are an attempt to ask a similar question to the elasticity approach in freight – what level of charge would deter the operation of trains.

In either case, we start by constructing a list of diagrams by net revenue per train mile, as previously defined.[36] The railway timetable is complex, and for the purpose of assessing MCB we have made adjustments to it that create "standard diagrams", in the form of a regular timetable with a standard stopping pattern, reflective of the general level of service operating on a given service code. These "standard diagrams" are intended to deliver the standard clock-face service level currently operating on the route. We have considered such "standard diagrams" to be operating against the "background" of other services on the line, such that the line overall retains its present level of service. The "background" includes services that follow the same route for all or part of the way, and additional services at peak times. In some cases, there are services in the timetable operating beyond the terminus of the "standard diagram", even though they ostensibly form part of the routine clock-face part of the timetable to that terminus, e.g., a Bristol service runs forward to Exeter. In this case, our standardised timetable retains the standard diagram treats this as two separate trains, so we can construct our "standard diagrams".

The subsections below explain our approach to the "monopolistic test" and the "competitive test".

5.1. The "monopolistic test"

In this test we remove some of the standard diagrams from the timetable, and consider what effect this has on the net revenue[37] of the train operator, using MOIRA to assess the revenue effect. From the change in profit, we can ask what level of charge would have encouraged the train operator to make that reduction themselves. We call this a monopolistic test in the sense that it assumes no competitive reaction by others to reoccupy the diagram. The overall effect would be a reduction in demand because of the reduced service level, although some passengers would travel on other trains. An argument for such a test is that most service codes are in effect monopolistic.

[36] The same underlying assumptions for revenue and cost were used as in stage 1 analysis.
[37] Precisely as defined in Stage 1

However, our work to assess the marginal profitability (in terms of net revenue) of diagrams showed that the tools we have for making these assessments are too sensitive to the simplifying assumptions that we have to make when using readily available data and models to be able to make robust conclusions. Nevertheless it provided useful indications that the likely result of such tests in many cases would be that it is profitable for a monopoly train operator to remove its worst performing diagrams, even with a zero mark-up charge. In practice we see that franchised operators do not behave like monopolists in specifying their timetable. There is a social cost-benefit test for determining service levels specified in the franchising system, such that franchise operators cannot limit the timetable to the most profitable timetable.

Overall we found that the monopolistic test does not provide a more useful estimate of a mark-up charge than the observation that open access operators can at least bear the current capacity charge (per train mile), which for example in the case of OAOs on the East Coast is around £0.50 per train mile,[38] in relation to their total business, as opposed to the system average of a little under £1.35 per train mile. While the capacity charge places a floor on a mark-up charge it does not assist with setting the upper bound. We therefore considered an alternative test, which we call the competitive test. We have therefore applied the competitive test to our analysis.

5.2. The “competitive test”

In a competitive railway market, if one supplier reduces supply, then another supplier can seek to replace them in the path vacated. A question would be, in what circumstances would they be willing to reoccupy it? MCB is related to the level of net revenue at which another operator would be willing to occupy the space, if they were free to do so. A mark-up charge can be borne if the space would be operated at that charge, because in a competitive market it would not deter the operation of that diagram.

However, the railway market has an unusual feature in that there are inter-available tickets and a degree of institutionalised revenue sharing. The effect of these arrangements is that revenue earned from entering into a gap in the timetable can be larger than the amount of money generated by fares from tickets bought to travel specifically on that train. Since MOIRA takes account of these effects, we take it into account in our estimates.

The level of net earnings (expressed as net revenue per train mile) that OAOs operators are willing to accept on the diagrams they operate provides an indication of where the boundary lies in terms of willingness to enter the market. What we can do, therefore, is compare the level of earnings that existing OAOs are willing to enter at, to those generated from unrestricted diagrams in comparable parts of the timetable. The difference between the

[38] The capacity charge wash-up mechanism means that OAOs can pay a higher rate of £1 to £3 on some train miles above a pre-determined baseline, which is currently a small proportion of their mileage, and does not materially affect this average.

minimum acceptable earnings of OAOs, and the actual earnings of those areas of the timetable for the incumbent operator, indicates the ability to bear of that incumbent, or of an unconstrained new entrant. Therefore, it would also be an appropriate range for an OAO if the not primarily abstractive test did not apply.

It is possible that, since open access diagrams are hard to obtain, that some OAO diagrams allow more than a normal profit to be returned. However most analysis of open access businesses have found that overall, OAOs operations do not show high profitability. For this reason we believe that it is appropriate to consider the net revenues of their weaker diagrams as an illustration of the boundaries of acceptability of the level of net revenues that OAOs are willing to accept. A criticism of this approach might be that in practice the least profitable diagrams are not necessarily earning the minimum that the OAO intended when it entered, but having entered and incurred some sunk costs it chooses not to exit the market. Evidence against that possibility would be that OAOs have continued to apply for additional access, implying they consider the opportunities valuable, at least in the longer run, and passenger demand has continued to grow. We also note that other aspects of our analysis are conservative – we have calculated net revenue using fully averaged costs and we have only included passenger revenue; this should act as a balance.

Our arithmetic approach to estimating a plausible mark-up that is able to be borne is as follows:

We calculate a mark-up charge that is able to be borne on a route, in the absence of a "not primarily abstractive" restriction, as

Y – X

Where

X is the minimum net revenue per train mile from an open access operator's diagram MINUS current Capacity Charge per train mile

(Because the OAO is currently paying the Capacity Charge so this is the actual net revenue, whereas we have reported net revenue excluding it.)

And

Y = Typical earnings of FTOC per train mile on typical diagrams comparable to open access diagrams, i.e. excluding the most profitable diagrams and some outliers

The reasoning behind this is that X indicates the minimum net revenue acceptable to a free market entry operator, whereas Y indicates what they might be able to earn without restrictions. Thus the difference is a charge that is able to be borne if they were not subject to such restrictions. It could also be considered as indicating a surplus currently available to the funding authority that would be at risk of being competed away in the absence of entry restrictions.

We demonstrate how this could operate in practice through fictional illustrative case studies, since we cannot show the actual case studies we have carried out for reasons of data confidentiality. The illustrative cases follow the broad form of the case studies and show how the analysis was carried out. They have been sufficiently modified that no information is available on the actual case studies carried out. The first considers a market which already has OAOs operating in it and the second considers a market in where OAOs have not yet entered.

5.3. Fictional Case Study analysis

We have carried out five case studies, comprising three intercity routes and two long-distance commuter routes. Open access operators are present in some but not all of the intercity areas we studied. Because the actual results of these studies rely heavily on confidential data, we cannot include them in the published report. The following two fictional case studies substantially indicate the mode of analysis in the actual case studies. Some of the actual case studies indicated net revenue per train mile much higher than others, but this does not affect the treatment here.

5.3.1. Fictional Case Study 1: Intercity routes with OAOs currently in operation

The fictional case study we present first is a market where there is currently one FTOC in operation, as well as an OAO, both of which follow the same intercity route for all or part of the way. The FTOC is timetabled using standardised diagrams, against a background of additional diagrams to create the overall level of service. The OAO is modelled using its actual timetable, which has many stations in common with the standard FTOC diagrams.

Our Stage 1 analysis demonstrated that intercity services tend to have the highest profit margins, and we have used the results of this analysis to develop this fictional case study alongside a standardised train timetable. In total, there are 5 diagrams operated by the OAO and 16 standardised diagrams operated by the FTOC on this route. The TOC may operate additional services in the "background" including service to other destinations with some calls in common, and additional peak services. The table below presents net revenue, per train mile basis, for the 16 standardised diagrams and the 5 OAO diagrams, under the same assumptions as in Stage 1. Hence, revenue is passenger revenue only.

Table 5.1: Fictional case study 1 – with OAOs currently in operation on similar routes, showing net revenue per train mile by diagram

Diagram	Net revenue per mile
Open access operator (OAO)	
OAO1	£7
OAO2	£10
OAO3	£11
OAO4	£5
OAO5	£13
Franchised train operating company (FTOC)	
FTOC1	£16
FTOC2	£3
FTOC3	£22

Diagram	Net revenue per mile
FTOC4	£12
FTOC5	£24
FTOC6	£14
FTOC7	£26
FTOC8	£12
FTOC9	£27
FTOC10	£18
FTOC11	£22
FTOC12	£11
FTOC13	£24
FTOC14	£20
FTOC15	£25
FTOC16	£32

The table above demonstrates that the least profitable diagram for the open access operator is diagram OAO4, which earns £5 net revenue per train mile. In terms of comparing these with standard FTOC diagrams we decided to focus on those that first arrive into the major UK city as these are usually the most profitable parts of the diagram. If we compare this with the standard FTOC diagrams, the most relevant would be FTOC8 and FTOC14. FTOC8 earns £12 net revenue per train mile and FTOC14 earns £20 net revenue per train mile.

OAOs in the UK, on average, tend to pay around £0.50 per train mile in capacity charges, as noted earlier, which is excluded from the cost estimates above under the assumptions set out in Stage 1 of the analysis. This tends to suggest that an OAO's appetite to run train diagrams runs out at around £4.50 per train mile (X in the formula above), (i.e. £5 minus £0.50 for capacity charge). This is achieved in a period of the timetable (FTOC8 and FTOC 14) when the FTOC is earning between £12 and £20 per train mile. We could say that these diagrams run in a space in the timetable where the FTOC is earning broadly around £16 per train mile, before deduction of capacity charge or any allocation of FTAC, (Y in the formula above).

Making this assumption suggests that the area of the timetable of least value to OAO, but which they are still willing to operate in, could bear a charge of at most £11.50 per train mile (i.e. £16 minus £4.50).[39] This gives us a range from a minimum of about £0.50 per train mile, indicated by the present average OAO capacity charge, up to a maximum of £11.50 in this geography.

Looking more broadly at the timetable, we find a number of standard FTOC diagrams for which net revenue is less than the £16 figure quoted above. On closer analysis some are defective diagrams of unmatched train services (in this example FTOC2) which did not admit a full day's operation for the train, but were required to complete the service actually in existence. The existence of these in the timetable might be explained by movements for maintenance purposes, or else because the train then runs services in the "background" or another service code. We exclude these as outliers. In the other cases, each one of these

[39] Since we have excluded the Capacity Charge from OAO costs, these amounts include the present £1.50 charge, and should be reduced by the amount of the Capacity Charge if it is retained.

diagrams is bracketed by diagrams of much higher income than £16. In reality we would expect these large differences in earnings potential in closely adjacent diagrams to be smoothed out by yield management, which our simplified revenue modelling methods cannot fully reflect. In other words, if in reality two diagrams close in time had a substantial revenue difference then it would suggest that there is a large difference in demand and/or fares between them. In such a situation it would likely be worthwhile the operator using its yield management techniques to reduce those differences. We tend to believe that the actual shape of yield across adjacent diagrams is likely to be more even than the variations our simplified modelling has calculated. We would therefore conclude that £16 per train mile is reasonable estimate of the earning potential of diagrams in these service codes at the margin, i.e. excluding those timings which are particularly advantaged. Thus £11.50 would seem a reasonable estimate of the maximum MCB ability of these codes, and would enable the present level of service to continue to operate, based purely on passenger revenues. There could even be some additional ability to bear given that we have not taken into account non-passenger revenues, which we understand to be typically in the region of 10% of total revenue.

Clearly the upper end of such a charge is well in excess of the actual earnings of OAOs at present, and they would not be able to bear such a charge. That is because it represents the value of diagrams to the FTOC, who have a number of advantages, most notably freedom from the timetabling restrictions placed upon OAOs.

5.3.2. Fictional Case Study 2: Intercity or commuter route with no OAOs in operation

It may be the case that the OAOs in the first case study competed away some of the FTOC's net revenue margin. Therefore, we considered it would also be interesting to study a route where no OAOs are yet operating. The table below presents net revenue per train mile basis, for 10 fictional diagrams, all of which travel along the same route.

Table 5.2: Fictional case study 2 –intercity route with no OAOs in operation

Diagram	Net revenue per miles
FTOC17	£24
FTOC18	£24
FTOC19	£27
FTOC20	£55
FTOC21	£60
FTOC22	£23
FTOC23	£40
FTOC24	£25
FTOC25	£27
FTOC26	£26

The majority of the diagrams cluster at around £26 per train mile net revenue, although a couple of diagrams earn substantially more. The margins presented in this example are, on the whole, much greater than those presented in case study 1.

The analysis from case study 1 indicated that open access operators are willing to accept a yield down to around £4.50 per train mile, after they have paid the present Capacity Charge. This suggests that the fictional service presented in this case study, where no open access operators are currently operating, could easily bear the aforementioned charge of around £11.50 per train mile, indeed one might argue that this geography could bear rather more. Indeed the amount that could be borne in this geography, by our formula, would be £21.50 per train mile.

For avoidance of doubt, none of the numbers shown above are those in our actual case studies, nor are they indicative of them, including the illustrative charge amounts. They are substantially different in many respects from the actual case studies.

5.3.3. High level conclusions of actual case study analysis

We developed five actual case studies, and for information a high level description of each is found in the table below. The table includes our indication of a mark-up which we believe all relevant markets could bear, as it is based on the more marginal of markets emerging from Stage 1. Some markets could well be able to bear a higher mark-up.

Table 5.3: High level description of Case Studies and high level conclusions noted

Case Study	Market situation	Observations
1	Intercity service towards the lower limit of Stage 1 net revenue per train mile of interest for charging. Some OAO competition on parts of the route.	We identified that the service code could conservatively[40] bear a mark-up of ✂ per train mile. This includes £0.50 for the current average capacity charge level for OAOs, assuming it does not apply in CP6.
2	Intercity service with somewhat higher net revenue per train mile compared with Case Study 1. Some OAO competition on parts of the route.	We identified that the service code could conservatively bear a mark-up of ✂ per train mile. This result was lower than expected, given the overall net revenue of this service is higher than Case Study 1. The reason is that demand is more peaked for this service, and off-peak net revenues are relatively lower. With a mark-up that does not vary by time of day, it is the off-peak that drives ability to bear such a mark-up.
3	Intercity service with high Stage 1 net revenue per train mile and no direct competition from an OAO or another franchised operator.	The mark-up from Case Studies 1 and 2 could easily be borne,[41] and potentially considerably more.

[40] Our modelling shows considerable sensitivity to the assumptions made, particularly to rolling stock choices.

[41] Based on case studies 1 and 2, and our professional judgement, and taking into account the sensitivities to assumptions, we have identified a mark-up in the range of £6 to £7 per train mile which could be borne by intercity services of the nature considered in these case studies. (Footnote provided for purposes of redacted version.)

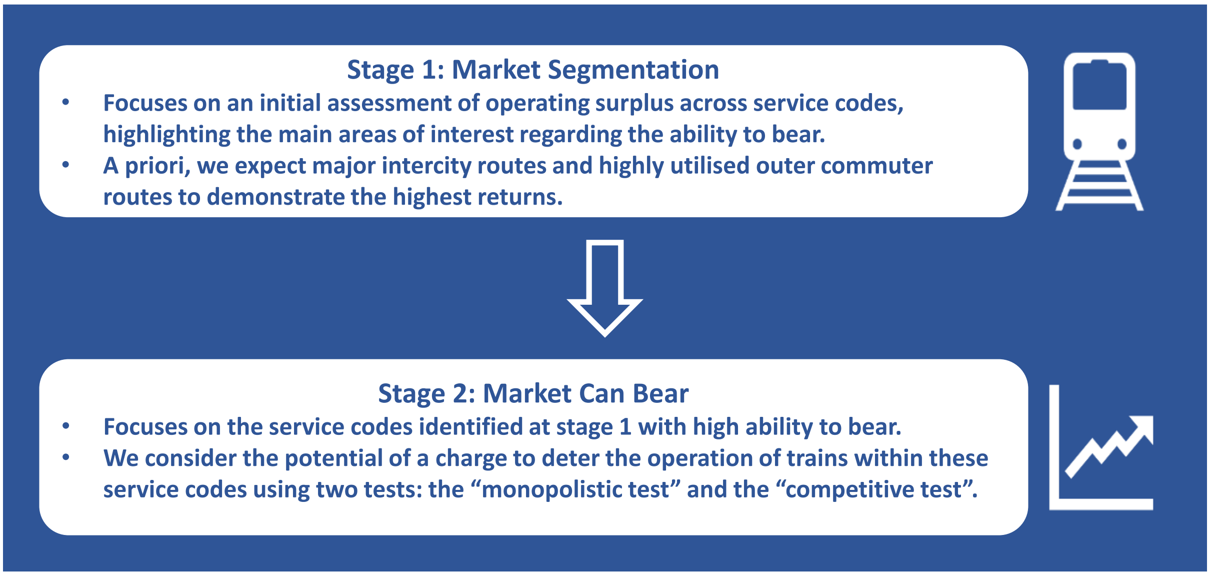
Case Study	Market situation	Observations
4	Outer commuter service with high Stage 1 net revenue per train mile and no close inter-franchise or OAO competition.	The mark-up from Case Studies 1 and 2 could easily be borne and potentially considerably more. This service lies intermediate between typical Intercity and Commuter services. The calculated level is very sensitive to cost assumptions and rolling stock choices, but clearly shows high ability to bear.
5	Outer commuter service with high Stage 1 net revenue per train mile, but with some major stops also served by franchised intercity service s.	Although overall the service code has high net revenue, some (more marginal) diagrams had relatively little ability to bear any mark-up, but this is sensitive to the rolling stock strategy selected. This result arises because (1) demand is heavily peaked; (2) a requirement to serve minor stations at a given frequency and journey time results in a high frequency to major stations and hence high off-peak excess capacity, which is costly to provide; and (3) substantial portions of revenue at major stations were being captured by the intercity service, and aspects of our conservative revenue modelling approach tended to accentuate this effect. It is evident from the overall revenue of the service code and related intercity service that the charge from Case Studies 1 and 2 ought to be able to be easily borne overall by an operator looking to exploit the commercial potential of this market. But it requires a very specific approach to segmentation to isolate quite where it would best be charged.

6. Conclusions

ORR appointed CEPA to consider the creation of a mark-up for passenger services based on ability to bear. The study requires us to propose a market segmentation for passenger rail services, and then conduct a market can bear test for each of the market sectors identified as having potential ability to bear a charge.

Our analysis has been conducted in two stages as shown in figure 6.1 below.

Figure 6.1: Overall approach



Our Stage 1 findings highlighted that the highest returns are achieved in the following market sectors:

- **Major intercity routes** – for example, services between London and other large UK cities like Birmingham, Manchester, Leeds and Liverpool.
- **Highly utilised, outer commuter routes** – for example, services between London and Colchester, Southampton and Cambridge.

In Stage 2 we undertook a series of case studies to explore the potential scale of ability to bear for different services within these two high level categories. The case studies included examples of major intercity routes with and without competition from OAO’s and the highly utilised commuter routes identified in Stage 1. The detailed analysis utilises confidential data and is therefore contained in confidential annexes that are unpublished, but some high level conclusions from them were summarised. For illustrative purposes we also apply our method to 2 fictional cases, but which produce realistic but fictional results and follow the method set out in this report.

Our underlying and confidential results suggest that ability to bear a charge varies considerably by route as does the amount that could be borne. One of our case studies was carried out on services at the lower end of the range of services with average net revenue above the benchmark level of net operating revenue for existing OAOs, which, as set out above, we have taken to be the minimum level acceptable to a commercial operator. Thus our emerging view is that most of the service codes within consideration, according to the Stage 1, assessment could bear a charge at the level emerging from that case study, which is around £6 to £7 per train mile. But those services that are closer to the edge of the category would require more careful examination. At the same time, it does appear that some specific geographical markets might be able to bear rather higher charges.

Present service codes, may well not be well aligned with geographical markets according to their ability to pay. When a FTOC sets its timetable it has regard both to the ability to earn revenue from customers and its obligations to provide service. The services we see operated do not present a clear separation between social obligation and commercial opportunity. Also, intermediate calls in longer distance markets can serve shorter distance markets. This can make it difficult to untangle where ability to bear lies, particularly in the commuter markets. Such cases need to be considered in the process of operationalising a market segmentation (for example by mapping service codes to market segments).

The nature of this work has been as a test of concept. In particular to enable the work to be done with reasonable despatch and effort we have used National MOIRA for revenue modelling. We have also been restricted to public data for cost estimation, which means our cost estimates are more approximate than would be ideal, having used standard average unit costs in a number of categories, albeit then calibrated back to individual TOCs' overall costs.

The Stage 1 analysis revealed that National MOIRA1 has considerable shortcomings for London Commuter flows in more complex parts of the network, and we would recommend that if this is taken further more refinement is required in the London Commuter area. Our Stage 2 analysis of services which are intermediate between Intercity and Commuter in terms of their operating characteristics indicated the difficulties with the coarseness of the high average level unit costs distinguished by such simple categories.

The Stage 2 analysis also revealed that the quantum of ability to bear a mark-up is contingent upon:

- How you define the market segment you are applying the charge to, and
- What are other services and their capacity that will run in the same area, as a result of franchise requirements, and also the intermediate calls of longer distance services.

In particular, we note that the presence of lower revenue service obligations and higher revenue major destinations in the same service code and also the same train, and the interleaving of longer and shorter distance services, can make it difficult to untangle where exactly where ability to bear lies. We have also found that our results are quite sensitive to the assumptions made, and thus more careful analysis will be needed, especially in cases which lie close to the boundary of interest.

We believe that we have identified the presence of substantial ability to bear a mark-up materially higher than the current capacity charge on intercity routes, even those towards the lower end of interest in the Stage 1 analysis, and potentially considerably more. This would also appear to be the case in the higher earning areas of Outer Commuter services identified in Stage 1. But the entanglements of less remunerative service obligations and the intermediate calls of longer distance services means that it is harder to define markets in a way that locates and isolates where ability lies in the commuter markets.