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Open access to railway networks: Hidden discrimination potential in an integrated railway organisation

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OVERVIEW

INTRODUCTION

Railways are fundamental to a sustainable and cost effective transport network but rail transport's market share for both passengers and freight fell significantly after the introduction of highways and the increased availablty of automobiles and trucks. An important goal of European public policy is to increse the use of rail transport.

One of the key problems identified with railways is the preponderance of state-owned integrated railways and the focus these railways have on their domestic networks. In an attempt to break-up this system and thereby improve the attractiveness and cost effectiveness of rail transport, starting in 1991, the European Commission has approved several directives requiring open access to railway networks. These

directives are being implemented on a step-by-step basis, but unfortunately the increase in rail transport's market share has been disappointing.

This paper considers the question of whether discrimination could be hindering the implementation of open access and thereby reducing its effectiveness. The idea is that the open access directives provide formal open access, but there may be other (less formal) ways in which an infrastructure owner (often a state-owned company) could discriminate in favour of its jointly-owned train operating companies.

The first section of the paper presents a background on open access in the rail industry, a description of European railway deregulation and its results to date, the potential for discrimnation in the railway system and circumstances in which discrimination could take place. The second section describes the railway production process and how discrimination could take place in each of the main processes. The third section describes how factors other than discrimination could be hampering the effectiveness of open access; these include abuse of market leading position by train operating companies, the conflict between regulatory responsibilities and profits for state-owned railway companies, and the difficulties faced by any new business. Finally, section four presents a summary and evaluation.

The rest of this paper considers whether an independent path allocation body can prevent discrimination against newcomer TOCs so that they have a fair chance to compete with sibling TOCs. This paper identifies possible instances of discrimination by analysing the planning and production process, combined with the author's personal experience.

This paper is based on an analysis of the opportunities for discrimination in the railway service production process. It is not based on detailed analytical analysis of any specific railway company or activities in any country. Instead it uses a systematic approach to consider the potential for discrimination based on the author's professional experience and a review of the general liturature.

BACKGROUND

Regulation and operation of railway infrastructure have been important since the first railways were built – and sometimes even earlier. In the 19th century European states developed and implemented very different railway infrastructure principles, each country's principles were based within the context of its own individual political, economic and national defence situation [19], [23].

Several European countries regarded railways as monopolies and therefore strongly regulated railway infrastructure construction, especially with regard to the strategic importance of railways for national defence [2]. Other countries preferred to let private companies and transport markets determine network design. There are several examples of competing railway infrastructure that were built following this approach, but they were generally economically unsuccessful. This experience showed that, even when railways had a monopoly in transport, the costs of infrastructure construction, operation and maintenance were too high to support more than one route between two points of interest. As a consequence there are almost no point-to-point relationships where a real choice exists between the infrastructures of two or more independent railway companies [29].

Today, railway companies in Europe are generally owned by the state within which it operates. The timing and processes that led to state ownership varied by country, but over time state ownership became the dominant model. Eventually many of these railways were even made part of the public administration. These national railways were fully integrated, they owned and built infrastructure and were responsible for operating nearly all passenger and freight services.

In some countries, notably Switzerland, Austria, Germany, Italy and Spain, private railways still exist. However, most private railways in Europe are actually owned by regional governments. Furthermore they are quite small. Even in Switzerland, where private companies own approximately 40 % of the network, about nine-tenths of the passenger demand and three-quarters of freight transport are carried by the state-owned national railway [24], [31].

Government ownership and operation has been blamed as a main reason for the decline of passenger and freight transport by rail in Europe. In the period between 1960 and 1990 rail's market share dropped to one-third of its 1960 value. By the early 1990s the average market share of EU-15 railways dropped below 10% for passenger services and under 15% for freight transport [9]. While the share of transport carried by rail was declining, roads and airports became seriously congested, creating a grave threat to Europe's position in the global economy and environmental sustainability.

EUROPEAN RAILWAY REFORM: DESCRIPTION AND REALIZATION

In 1991, the European Commission introduced its first set of regulations for deregulating European railways. The goal of deregulation was to improve European railway performance and service quality [11], [22]. These goals are intended to help the railway system compete more successfully with road and air transport. Deregulation is expected to help achieve these goals by fostering competition between different railway companies. The general aims of the European Commission may be summarized in the following three points [5], [6]:

1. Greater competition in the supply of transport within each mode. This emphasizes reducing market entry costs.
2. Fair competition between transport modes by considering the external costs and coordinated infrastructure access prices.
3. Provide sufficient transport infrastructures.

European Community Directive 91/440 provided a first important step in realizing these principles in the railway sector. The EC has issued several additional directives providing more details, but has not altered Directive 91/440's basic principles. These basic principles are [5]:

- Management of railway companies should be independent from the state. It should follow the same economic principles as any commercial undertaking.

- There should be separate accounts for the infrastructure part of the business and the train operations part of the business.
- Network access should be open and provided at non-discriminatory rates.

As outlined earlier, for most point-to-point transport relationships there is only one reasonable rail route. Furthermore, given the economics of railway infrastructure, it essentially impossible to build alternative routes to enable competition between independent railway infrastructure owners. In other words, the market for railway infrastructure operates as a natural monopoly. The only way to provide competition in this case is to provide open access under the same conditions for all companies to the single route available.

European Community policy specifies a stepwise introduction of open access on the entire European standard gauge network. The railway reform policy is designed to break-up the industry's traditional monopolistic structure, but it allows countries to use different ways to achieve this goal.

There are two main ways of achieving open access. The most obvious approach is to divide infrastructure from operations by creating separate companies for each activity. However, European policy also allows a second approach: keeping infrastructure ownership and train operating services together in the same company as long as certain specified conditions are fulfilled.

Most countries took the first approach. The United Kingdom was one of the first to implement the system, separating the former state-owned railway company into a infrastructure company and several independent train operating companies (TOC). In contrast, a few countries in Central Europe – a minority of European countries – took the second approach, namely separating infrastructure and train operations into different business units within the same holding company [20]. Under this approach each business unit must have its own independent organization and financial controls. In this paper a train operating company owned by the same holding company as an infrastructure company will be referred to as a "sibling TOC" to highlight the relationship between these officially independent business units.

The European Community accepts actually two precise ways to organize the interplay between infrastructure network operators and TOCs [12], [13]:

- Full separation between the network and the incumbent TOC. In this case there can be no inter-company relations beyond normal contacts between a network operator and any TOC.
- Maintaining of integrated railway companies, but path allocation has to be handled and decided by a fully independent body.

It's interesting to note that the idea of the open access isn't new. In fact, open access was seriously considered early in the history of railways and until about 1830 many people believed strongly that railways should be treated simply as another type of roadway. Therefore the first railway lines in Great Britain were built so horse-drawn vehicles could use them [18], [30]. Similarly, the Prussian State Railway was designed for open access and even had developed an early track access charging system [16].

FIRST RESULTS OF EUROPEAN RAILWAY DEREGULATION

The results of European railway deregulation have been disappointing both in terms of the degree of open access achieved and in terms of the transport modal shift from road to rail [10]. First, there are significant differences in the degree to which the principles of EC Directive 91/440 have been implemented between the European countries; by 2007 only four countries had made advanced progress in achieving the principles of open access. Furthermore, competition is not as strong as expected even in the few countries that do have open access [14]. It seems clear that the opportunities for network access provided under the formal regulations are not being used as often as theoretically possible.

Given these disappointing results, it could be argued that the principle of the open access is based on an incorrect analysis of the market structure and is fundamentally inappropriate for railway transport. However, by looking more closely at results in countries with open networks (United Kingdom, Germany, the Netherlands and

Switzerland) it is possible to better evaluate open access in theory and practice. In these “open access” countries there has been a considerable increase in railway demand, making the case that open access can strengthen the competitive advantages of railways [7].

For example, in Switzerland the amount of Transalpine freight carried by rail increased from 17.5 million tons per year (1990s average) to 25.3 million tons per year in 2007 [25]. At the same time, the incumbent’s (SBB freight company) share in this market dropped from its traditional value of about 75% to 55% [33]. The additional competition made it possible to stop the loss of rail market share to road transport [25].

For regional passenger services in Switzerland, the open access and the opportunity of intramodal competition was introduced in 1996. Since then, the subsidy for the SBB’s regional services dropped from 816 Million CHF/year in 1996 to 414 Million CHF/year in 2004. In the same time, train-kilometers of regional services grew significantly [27], [28], [32].

On the European level however, it is clear that deregulation has not been as successful as had been hoped. One reason could be informal discrimination against newcomer TOCs. This discrimination could make it more difficult for new companies to enter the market and thereby reduce their ability to increase competition. The rest of this paper focuses on how discrimination may be reducing the benefits of open access.

DISCRIMINATION POTENTIAL IN INTEGRATED RAILWAY COMPANIES

One of the key explanations for the contradiction between the formally guaranteed open access and the modest intensity of real competition on the rail network is discrimination against newcomer TOCs in the path allocation process. The explanation is that infrastructure companies would discriminate in favour of their sibling TOC in allocating paths. This problem was recognized early in the process of implementing open access and was addressed by requiring countries that do not fully

separate infrastructure and train operations to create fully independent train path allocation bodies [15].

Nevertheless, newcomer TOCs still complain of discrimination in every country where there is not strict separation between infrastructure owners and providers of transport services. To explain this situation, this paper is based upon the following assumption: the potential for discrimination under open access is not limited to the path allocation process, but rather can be practiced throughout the railway planning and production process. This assumption is based on the following two facts:

- TOCs purchase not only paths from the infrastructure companies, but numerous other resources and services; this gives the infrastructure company many opportunities to act in favour of sibling TOCs.
- The services provided to TOCs are themselves the result of the infrastructure company's internal planning and production chain. The infrastructure company's priorities (e.g. capital investment priorities for creating paths) could be set to act in favour of sibling TOCs.

In other words: infrastructure companies can discriminate against newcomer TOCs in favour of sibling TOCs both in terms of how they allocate existing resources to the TOCs, but also in how they chose to improve their own production processes.

It should be underlined at this point that there is a substantial difference between rail and road transport. Both roads and rail lines are natural monopolies, but roadways operate under almost total open access. Almost all aspects of roadway transport from planning to construction, from operations to support are provided by highly competitive companies. Specific examples include fuel supply, vehicle repairs or information services. A formal path allocation system for roadways isn't necessary except in cities and on heavily loaded parts of the network, but even in these cases, the control systems used including traffic signals or highway traffic management systems are run by completely independent authorities.

CIRCUMSTANCES LEADING TO DISCRIMINATION

Before considering the different types of discrimination it is important to understand what circumstances may lead to discrimination. For purposes of this paper, the following conditions are necessary to be considered discrimination:

- A single integrated company owns both the railway infrastructure and one or more TOCs (sibling TOCs); thus the company profits financially when its infrastructure company provides advantages for the TOCs it owns.
- There are one or more completely independent TOCs that want to use the infrastructure network. These independent TOCs might be competing directly with the sibling TOC or may only be competing for track capacity.
- The infrastructure company must make decisions between contradictory interests of a newcomer TOC and one of its sibling TOCs.
- Alternatively the infrastructure company must decide on a request from an independent TOC although their sibling TOC is not involved. For example, an independent TOC requests a path with special qualities.

These circumstances mean that there is a very high potential for discrimination in the case of integrated companies that own infrastructure and TOCs operating under open access regimes. Discrimination may appear in many ways including:

- Two or more TOC’s are handled differently for no objective reason; the sibling TOCs are preferred by the infrastructure unit.
- Different prices are charged to different TOC’s for the same services.
- Certain services are withheld from some TOC’s.
- Network investments address specially the needs of sibling TOCs; the needs of other TOCs are neglected.
- The infrastructure company sets technical standards that can be easily fulfilled by sibling TOCs, but which cause serious expenses for other TOCs.
- Administrative procedures are developed that are easy for the sibling TOCs to fulfil, but are difficult for other TOCs.
- Administrative procedures are handled in a way that helps the sibling TOCs.

In summary, discrimination in railway network access addresses many more issues than simply the slot allocation. It is necessary to look closely at the whole railway planning and operations process to determine whether an infrastructure company is behaving in a discriminatory manner.

DISCRIMINATION POTENTIAL OF NETWORK OPERATORS

RAILWAY INFRASTRUCTURE PRODUCTION THEORY

This paper is based on the theory that railway infrastructure can be considered to be a production plant; this production plant is used – together with rolling stock and other resources – to produce passenger and freight transport services. Similar to any production plant, the system architecture and technical standards depend on the products that are to be manufactured. Furthermore, there are many interactions between the railway infrastructure and the TOCs during the production process. Finally the geographical dimensions play an important role in system operations.

In simple terms, the following key conditions must be fulfilled to enable a given train to operate on a specific track segment (infrastructure):

- The administrative procedures must be short and reliable.
- The capacity needed must be available.
- The technical interfaces between train and infrastructure must be compatible.
- The information flows must be complete and correct.
- The support needed during operations must be provided.

The paper uses this production plan theory to systematically evaluate each stage in the process, seeking to identify opportunities for discrimination. Discrimination can be defined as taking place when an infrastructure company does not treat one TOC the same way it treats another TOC in the same situation with respect to any one of these conditions. It’s important to recognize that the specific conditions listed above

must only be fulfilled when the train is scheduled to run, however they are the result of a long planning and development process and there is potential for discrimination throughout this process.

Given the need to look closely at the entire railway production process, this paper considers how discrimination could take place in each of the main steps of the railway production supply chain, specifically:

- Network planning and development
- Network access conditions
- Slot allocation process
- Technical strategies and migration
- Train operation
- Information management
- Staff requirements

As outlined in the introduction, this paper is not based on a detailed analysis of any specific countries or network access regulations, but rather on a completely generic analysis of opportunities for discrimination in the railway production process.

DISCRIMINATION IN NETWORK PLANNING AND DEVELOPMENT

One of the first opportunities for an infrastructure company to practice discrimination is in the process of network planning and development. The network development process may be discriminatory because the existing network topology largely defines its future capacities. When the infrastructure company plans its future network topology (and, in fact, all types of facilities including shunting yards, holding sidings, passing tracks at stations and network connections), it makes explicit decisions on future capacities and bottlenecks. The specific tracks and facilities that are built will help determine whether a given operating concept can be realized or not. In this case there are three main types of discrimination:

- The infrastructure company can plan and develop its infrastructure to meet the future needs of its sibling TOC, providing that TOC a significant long-term competitive advantage over other TOCs.
- The timing of network investments can also be critical. If the infrastructure company does not provide the infrastructure when the TOC needs it, the TOC's operating strategy may be a failure. Again, if infrastructure companies were more responsive in building infrastructure needed by a sibling TOC, this would be discrimination.
- Finally the infrastructure operator may charge fully independent TOCs more money to build a particular network improvement project than it would charge its sibling TOC for the same improvement. In this case sharing the costs between the infrastructure unit and TOCs is influenced by the relationship between the two partners.

In summary, there is significant potential for discrimination in the network planning and development process. To reduce this potential it's important to have a common planning process that includes future TOCs using the network.

DISCRIMINATION IN NETWORK ACCESS CONDITIONS

The next set of opportunities for discrimination consists in the process of setting network access conditions, for example the track access charges or the technical requirements for operating on the network. More specifically:

- The track access charging system may be designed in a way that is advantageous for sibling TOCs. For example, the infrastructure company can offer bulk discounts, i.e. lower slot prices for TOCs that buy a large number of slots. While it can be argued that providing bulk discounts is justified by economies of scale, bulk discounts are a significant problem because every newcomer starts by operating fewer trains than the incumbent national railway company.

- The infrastructure company could also charge an independent TOC a higher price for certain services (e.g. power supply and services) without justification (e.g. where no argument can be made in terms of economies of scale).
- The infrastructure company may fix especially high operating standards for access to attractive slots. For example, they might specify extremely short running times on a given line, thus essentially requiring the use of heavily powered and expensive electrical locomotives. This could, in turn, foreclose the implementation of cost effective production concepts by independent TOCs such as providing freight feeder services using small diesel locomotives. Another example that on a mountainous railway line, the infrastructure company could require that independent TOCs use two or more locomotives, even if the incumbent freight railway is allowed to use one locomotive for the same paths.
- Finally, the infrastructure company could set a special technical requirement (this is often done for rolling stock) that just happens to be already met by the sibling TOC.

In summary, this list shows that most of these types of potential discrimination are not implemented through an unfair track access charging system, but indirectly through supplementary requirements. The additional costs caused by these requirements are a significant barrier to open access.

DISCRIMINATION IN THE PATH ALLOCATION PROCESS

There are two main reasons discrimination is possible in the slot allocation process. First, there is no exact formula for calculating the capacity of a line segment, node or network. Instead, the International Union of Railways (UIC) defines railway capacity as a function of the following elements [26]:

- Average speed: there exists an optimal speed on every line, which is normally between 70 and 90 km/h. If a train is faster or slower, it consumes relatively more capacity.

- Number of trains: the more trains operate on a line, the more difficult it is to insert an additional one.
- Operating heterogeneity: the highest capacity is achieved if all trains have the same operating characteristics; in contrast, if trains differ with respect to speed, acceleration or stopping pattern the capacity is lower.
- Timetable stability: the higher the timetable stability, the higher the capacity.

In the end, the question of how many trains can be run on a railway segment depends on the level of risk acceptable to the infrastructure company with regard to operational stability and service quality. This means that the infrastructure company could accept a higher risk when a sibling TOC asks for an additional slot, whereas it would refuse to accept an additional train from a fully independent TOC under the same circumstances.

The second reason for discrimination in the slot allocation process comes about because of the qualitative differences between different slots. For example, a certain slot on a track segment may be preferable because it fits well with the slots on the preceding and following track segments and/or because it allows the train to be operated at exactly the desired time. In this case the infrastructure company can allocate higher quality slots to its sibling TOC and lower quality slots to the independent TOCs.

Specific examples of discrimination in the path allocation process include:

- The sibling TOC is given its preferred paths without any justification.
- An independent TOC's path request is rejected because it conflicts with previously booked higher priority train paths (e.g. passenger train paths). When the sibling TOC requests a similar path, the infrastructure company eliminates the conflicts by optimizing the schedule, enabling it to accept the path request. In case of the independent TOC's request, the previously booked paths are considered as boundary conditions.
- The infrastructure company offers independent TOCs only paths of inferior quality. For example, paths that require trains to wait on a passing track to let

other trains overhaul, thus increasing the independent TOC's running times and costs.

- The infrastructure company accepts additional trains from the sibling TOC although they threaten the network stability. Under the same circumstances it rejects requests for additional paths from independent TOCs.
- The path allocation process is handled slowly in case of an independent TOC's request. This is especially disturbing for freight companies since they have a high share of short term demand and have customers who need quick replies. If the slot allocation process is slow, they are not sure for a long time whether they may accept the customer's order.

These examples show that discrimination potential in the path allocation process is not simply a matter of "who gets the path" but rather is impacted by the way the path allocation process is handled and how the operational risks of a heavily loaded network are weighted.

DISCRIMINATION IN SETTING TECHNICAL STANDARDS AND MIGRATION

Another opportunity for discrimination is in the setting of technical standards for the infrastructure and migration paths for adopting new operating standards and infrastructure systems [1]. In each case there are migration paths which may fit well with the needs of the sibling TOC, but which are economically difficult or infeasible for independent TOCs. Specific examples include:

- The infrastructure operator follows an infrastructure strategy that fits best with the sibling TOC. Specific examples include: train safety systems, power supply systems, clearance, platform heights etc. Although the EC's Technical Specifications for Interoperability (TSI) will ultimately lead to compatible infrastructure, this will be a long lasting process taking several decades for mainlines and even longer for some secondary railway lines. Consequently, the most problematic discrimination of this type could take place on regional rail routes and local freight services.

- Every technical standard (e.g. electrical supply voltage) fixes certain technical limits and boundaries. Setting these standards often depends on the safety and reliability risks to be taken in the interplay between onboard and line-side equipment. Setting these standards may be abused by defining requirements that cannot easily be met by independent TOCs.
- Probably the most important discrimination potential in this area consists of choosing a migration strategy, i.e. defining the priorities, steps and timeline for introducing new technologies. Many new infrastructure systems, for example line-side safety technologies (e.g. European Train Control System – ETCS), impose new and costly requirements for onboard systems on the rolling stock. Even if the long-term results are the same, the speed and priorities of system changes play a major role the competitiveness of TOCs. Problems occur specially if the infrastructure company decides to convert a track segment to a new technology quickly and the sibling TOC has already equipped its trains with the required onboard systems. This requires the independent TOC to invest a large amount of amount of money in a short time just to be allowed to operate on the upgraded line.

The international harmonization of the technical standards that will be brought about following implementation of the TSI will help to reduce this discrimination problem, but this will take a long time. Furthermore, there are serious doubts regarding whether full interoperability of the European standard gauge network will ever be achieved in practice. For example, experience implementing the standardized ETCS has shown that there are national refinements, leading to the strange situation that the opening of the High Speed Line Zuid between the Netherlands and Belgium has been delayed by national differences in the ETCS specifications [21].

DISCRIMINATION IN TRAIN OPERATIONS

Another potential area for discrimination is in the actual process of daily operations. For example:

- All trains operating on a given line are controlled by a dispatching centre run by the infrastructure company. (In contrast, motor vehicles and airplanes are controlled by a fully independent body.) Perhaps the most important part of the dispatching process is making decisions regarding delayed trains. In this case dispatchers must decide whether one train should be preferred to others in order to minimize its delay or to avoid further delay, but this decision must be weighed against the impacts on other trains. Although there are some rules for acting in a given situation, dispatchers have broad discretion for their decisions. This means they may give priority to trains operated by their sibling TOC over those operated by independent TOCs.
- Some sections of track have automatic systems that check the technical state of the rolling stock (e.g. wheel temperature or the state of the brakes). When these systems identify a defect, the dispatching centre must decide what action to take. The dispatchers may choose to follow a low risk strategy in the case of independent TOCs while accepting a higher risk in the case of trains operated by their sibling TOC. This means that an independent TOC's deficient train will be stopped as quickly as possible, whereas trains operated by the sibling TOC will be allowed to run to the next suitable station. In this case, it is likely to be much more difficult to repair the independent TOC's trains leading to increased costs and delays.
- A closely related problem is the ability to repair rolling stock en route. When rolling stock is damaged and cannot continue its journey, the affected train needs support from a local organization (i.e. infrastructure company staff). This support staff may provide help quickly in the case of a sibling TOC, but slowly and at high prices in case of an independent TOC's train.
- All trains need various services to operate including water, fuel, power for advanced train heating, etc. These services are generally provided by the infrastructure company's local staff. However, the infrastructure company can refuse to provide these services, provide them only at inconvenient locations/times, or provide them at high cost to independent TOCs. In any case, this means higher production costs and a loss of productivity for the independent TOC.
- In some cases the infrastructure company provides shunting services. This is another opportunity to favour sibling TOCs over independent TOCs by

shunting sibling TOC wagons more quickly or charging lower fees. More seriously the infrastructure company may stop offering shunting services altogether in a location if the sibling TOC no longer needs shunting there. In this case the independent TOC would be forced to start its own shunting service, an expensive undertaking.

While these points may seem to have less importance than slot allocation, they do have a real impact on train service quality and railway company productivity.

DISCRIMINATION IN INFORMATION MANAGEMENT

Infrastructure companies have an enormous amount of information on train planning and operations for the entire network. This information is valuable because the infrastructure company is the only organization that sees and records everything that happens on the railway. This information can be shared with sibling TOCs, providing them with information on their competitors and markets [17]. There are several critical issues concerning discrimination in the information management area, specifically:

- Very sophisticated planning tools and databases are used to plan train paths. These tools are operated by the infrastructure companies and contain important information on every train, such as the name of the TOC, the type of the train, its origin and destination and so on. Obtaining this information about competitors is very useful, especially for freight railways, because it allows companies to develop products and offers that can be used to attract customers away from competitors. If infrastructure companies share this information with sibling TOCs it provides a significant advantage to the TOCs.
- All TOCs need to have accurate real time information on the location of their trains. The infrastructure companies control the systems that provide this information. The infrastructure company may make it harder for independent TOCs to obtain information (e.g. more expensive, less timely information, require complex data transfer equipment) than for their sibling TOCs.

Furthermore, the infrastructure companies could give real time information on the independent TOCs trains to their sibling TOC.

- In addition to being important for operations, TOCs need to provide information to their passengers and freight customers regarding delays etc. In stations this requires means for communications such as loudspeakers or display boards – which are controlled by the infrastructure companies. In other words, providing information to customers regarding scheduled trains, delays and changes depends on the infrastructure company. This starts with the simple willingness to display printed schedules for independent TOCs at the stations and extends to providing real time information about supplementary services and delays.
- Finally, all TOCs need historical information on the operations to help them optimize their production processes and also to help prepare for negotiations with infrastructure companies. As outlined above, the infrastructure companies collect this data and can decide whether or not to provide it to TOCs. When the infrastructure company is willing to provide this data, it can make it difficult by imposing data transfer conditions or requiring the TOC to have compatible equipment. Discrimination takes place when infrastructure companies provide data under different conditions to sibling TOCs than to independent TOCs.

In general, it seems to be easier to prevent the abuse of information by infrastructure operators and their sibling TOCs, than it is to make sure that the independent TOCs get all the information needed at the quality required.

DISCRIMINATION IN STAFF RELATED FUNCTIONS

Although many requirements concerning railway staff are fixed by administrative bodies [3], there are nevertheless several opportunities for infrastructure companies to favour sibling TOCs. Specific examples include:

- Railway operating staff need specific information and support from infrastructure staff (e.g. train drivers need knowledge about the track sections where they are working). The infrastructure company can discriminate by

providing more or less information to TOCs and providing this information in a timely or non-timely manner.

- Several categories of infrastructure company personal (e.g. shunting staff, scheduling experts or operations planners) could be helpful for TOCs. These staff could provide both technical skills and practical experience on specific railway lines. The infrastructure company can discriminate by preventing (or making it hard) for these staff to take jobs in an independent TOC while encouraging them to take jobs at a sibling TOC. This makes it difficult for the independent TOCs to obtain qualified staff.
- Infrastructure companies may also control service facilities for staff on their network (e.g. break rooms). In this case they may not allow staff from independent TOCs to use these facilities but allow staff from sibling TOCs to use these facilities. This forces independent TOCs to build their own facilities and/or obtain the services from elsewhere – often increasing costs and reducing efficiency.

A special issue about staff is that most railway professions are relatively unique. Therefore, staff with a railway experience must be considered as a natural monopoly in the short term.

ADDITIONAL OBSTACLES HINDERING MARKET ENTRANCE

OVERVIEW

The previous section outlined potential ways that infrastructure companies could discriminate in favour of their sibling TOCs. However discrimination is not the only problem faced by newcomer TOCs when they attempt to use rail infrastructure in other countries. This section describes some potential ways in which market leader TOCs could abuse their position to hinder open access to rail networks, the inherent conflict for governments that both regulate the rail market and own shares of railway

companies, and the difficulties faced by any new businesses operating in an industry as complex as railways.

ABUSE OF MARKET LEADING POSITION BY TOCs

A market leading TOC is defined as the TOC that dominates service on a given network. Many of the operating divisions created by breaking-up the national railways fall into this category. These incumbent operators have significant advantages over newcomer TOCs simply by virtue of their long presence in the markets and the facilities and services they control.

These examples illustrate the potential for abusing market leading position by existing TOCs:

- The market leading TOC is not willing to provide services to another TOC, which the other TOC can only produce at extremely high costs. This could occur if one TOC already operates service on a given part of the network and has developed its local organization there. For example, consider a freight railway company with local shunting locomotives and teams. It could simply refuse to do shunting work for another TOC.
- The market leading TOC is part of a TOC group enabling it to provide services that could not be provided by an independent TOC. For example, a passenger railway TOC group consists of TOCs that operate long-distance trains and TOC's that operate regional trains. In this case group member TOCs could coordinate their regional and long-distance trains into an optimized, customer-friendly and less expensive service offer for the administration ordering the regional services. In contrast, an independent TOC is forced to schedule around the given long-distance services and therefore its offer will be less attractive due to higher costs and lower quality.
- The market leading TOC TOC abuses its financial power and resources to push other TOCs out of the market. For example, the dominant TOC could offer regional administrations ordering services quick capital investments or service at prices lower than costs.

- The market-leading TOC refuses to allow competitor TOCs to use its maintenance facilities or to perform vehicle maintenance for the competitor TOC, even for a good price.
- The market-leading TOC refuses to help the competitor TOC in case of a locomotive defect or train problem; or charges very high prices and/or provides help slowly.
- The market-leading TOC refuses to publish information from the competitor TOC in its timetables.

While any of these actions can be taken by a market leading TOC with or without cooperation from its sibling infrastructure operator, if both business units act together to impede the independent TOC it makes the situation worse.

The significant level of power that market leading TOCs have over small independent TOCs seeking to start new services are directly related to the following three characteristics of the railway business:

- Production is distributed over an entire network, not concentrated in a factory. That means that every TOC needs to have access to all production resources everywhere it runs service.
- Most of the services trains need are linked to the rail line. For example, normally it's not possible to send a truck to help a damaged train.
- The services needed to operate a railway require special equipment and/or know-how that are only available from other railways.

These characteristics make it much easier to abuse a market leading position in the railway sector than in other sectors of the economy.

CONFLICT BETWEEN GOVERNMENT AS REGULATOR AND OWNER

Another problem for newcomer TOCs seeking to begin service is the potential for government agencies to discriminate against TOCs through administrative procedures. As government agencies none of these bodies should ever discriminate,

nevertheless the potential exists given the simple fact that, in the case of a state-owned integrated railway company, the state plays a double role:

- As a regulatory body, the state must act without giving preference to any single company.
- As the owner of a railway service provider, the state must act in a way that supports the company's financial success.

In this conflict the state may act differently on these two levels:

- On the legal level, the state develops and implements laws preventing discrimination in railway network operations.
- On the regulatory level, the state executes its administrative responsibilities in a manner that supports its own company.

There are several ways the state could execute its administrative responsibilities in a manner that supports its own company, including:

- The regulatory agency could process requests for rolling stock licenses to operate on its network from independent TOCs very slowly. The process could be delayed by asking for additional information, new tests and official certificates and/or setting-up a process that must be completed in a step-by-step fashion. The agency may even change the requirements during the process in order to further delay licensing. The effect will be that permission comes too late and the independent TOC loses its potential markets.
- The regulatory agency could require TOCs to meet extremely high insurance or financial standards in order to be allowed to use the network. This would prevent small independent TOCs from gaining access.
- The regulatory agency could impose very high standards for TOC staff knowledge in order to be allowed to use the network. Again, this would make it difficult for new independent TOCs from gaining access.
- The regulatory agency could impose very high standards for the TOCs in terms of safety certification, once again making it difficult for new independent TOCs to gain access to the network.

It should be emphasized that this paper is not accusing any state of abusing their administrative powers in the ways listed above or any other way; the description above only aims to make clear the principal conflict inherent in public ownership of railway service operators in liberalized rail market conditions. Given the inherent conflict, it is inevitable that regulatory agencies will be faced with contradictory aims and thus there is a high risk for discrimination or the impression of discrimination.

NATURAL DISADVANTAGES FACED BY NEWCOMERS

This paper has focused on the possibilities for discriminating against independent and/or new train operating companies. However, it is also clear that these TOCs are confronted by several natural obstacles to success including the [4]:

- High capital investment requirements, especially for locomotives and IT-systems.
- Need to hire and organize a highly specialised staff.
- Need to develop a customer network.
- Need to implement complex management structure and its related processes.
- Need to implement railway operational processes.

Given the high technical, organisational and operational complexity of the railway business, these obstacles may be formidable. However, there are several new solutions to these problems that can help newcomer TOCs enter the railway market. These include locomotive brokerage services, railway staff consulting companies, and other specialized businesses catering to the new open market for railway services. It is also likely that the number of these businesses will increase as open access becomes more widespread. In other words: given fair conditions the natural obstacles to starting new railway service seem to be surmountable.

EVALUATION

ABILITY OF INDEPENDENT PATH ALLOCATION BODIES TO PREVENT DISCRIMINATION

As mentioned above, the potential for discrimination in path allocation was recognized early in the process of implementing open access. Therefore countries organized independent path allocation bodies to fairly allocate paths to different TOCs.

The sections above used a systems engineering approach to identify and investigate different types of discrimination that can take place when a TOC attempts to gain access to a given railway network. Specifically, the evaluation considers the potential for discriminating against a TOC requesting network access through the entire railway production chain. The paper focuses on the production chain because, while an independent path allocation body is able to allocate existing resources (e.g. slots) in a discrimination-free manner, it cannot prevent discrimination on most other elements of the chain. To summarize, the main forms of discrimination identified in this evaluation are:

- Network planning and development: Decisions about future network improvements and/or capacity elimination
- Network access conditions: Technical and operational requirements for the use of the defined paths
- Path allocation process: Allocation of paths of the desired quality through heavily loaded parts of the network
- Technical strategies and migration: Migration schedule of sensitive technologies
- Train operations: Priorities in case of delayed trains or infrastructure disruptions
- Information management: How much operational information is provided to TOCs by infrastructure company information systems
- Staff requirements: Hindering the hiring of infrastructure staff by a new TOC

For all these issues, an independent path allocation body is only able to address the path allocation, i.e. only a relatively small part of the discrimination potential. Therefore, an independent path allocation body isn't sufficient to guarantee discrimination-free open access to a railway network. This conclusion is supported by the arguments of existing integrated railway companies, many of which say that separating their TOCs from their infrastructure would reduce synergy. This proves that the synergies between the infrastructure network and TOCs go much further than simply optimised slot allocation.

While independent path allocation bodies today do not have the responsibility to investigate and control more involved forms of discrimination such as those listed in this report (or others), it is also unlikely that such bodies could effectively police these quite complex forms of discrimination. Especially problematic are:

- Allocation of infrastructure improvement funds and scheduling of network improvement projects
- Acceptance of additional trains in heavily loaded parts of the network, definition of the network saturation with regard to the stability of the entire network
- General migration strategy of new railway technologies
- Priorities in case of delayed trains or infrastructure disruptions
- Discrimination by administrative bodies

Given the complexity of the railway production process, it's probably not possible on a theoretical or practical basis for an independent path allocation body or other body to fully prevent discrimination by infrastructure companies in favour of their sibling TOCs.

CONCLUSIONS AND OUTLOOK

The following four general conclusions can be drawn from the findings described in this paper:

- As competition increases, the potential for discrimination grows in networks controlled by integrated railway companies combining infrastructure and TOCs.
- Abuse of market leading position will become more frequent as more sectors of the railway business are allowed to compete. The next important step in this process will be the liberalization of international passenger services in 2010.
- The incumbent railway companies are also the market leaders for historical reasons. Market leaders have additional means of discrimination at their disposal. Especially problematic is the combination of an infrastructure owner with market leading TOCs in the same company since these companies combine the potential for both indirect discrimination by the TOC and direct discrimination by the infrastructure company.
- In the case of integrated railway companies wholly or partially owned by the state, the state plays two competing roles: that of a regulator and that of a shareholder. There is potential for abuse in these competing roles.

These findings support the conclusion that infrastructure companies and train operating companies must be completely separated in order to enable real competition on the standard gauge railway network (a key aim of European transport policy).

It has to be highlighted that this conclusion (separation of infrastructure from operations) is only a consequence of the principle of open access. In other words, it is based on the belief that open access itself is advantageous for the railway system.

Often it’s argued that separating infrastructure from operations leads to a loss of network optimization potential and raises the question of whether the overall railway network efficiency will suffer under strict separation. This paper does not address this question specifically, but looking back several years, several clear developments should be noted:

- The development of the rail freight market since introduction of open access in central Europe shows that the old business model of national oriented railways

is not well adapted to today's market needs. Today no freight railway company is organized as it was before 1999 and, as a result, rail freight transport has grown significantly and there was even a small gain in market share.

- Similar improvements have taken place on regional passenger railways; for example timetable densities have been increased significantly and new rolling stock has been purchased, both resulting in higher quality service for customers.
- The expected open access for international passenger services in 2010 has already caused new companies to invest in high speed rolling stock.

These results show that open access leads to more market oriented railway services and business models. Going back to the old system would destroy this progress, would counteract to the political goals of the European Community and would place in doubt the railway's future as important means of land borne transport.

In other words, while the separation of railway operations and infrastructure is not the aim of European transport policy, it is a consequence of the obviously successful principle of open access. In such circumstances, the relationship between infrastructure companies and TOCs has to be created from scratch. This reorganisation goes much further than simply separating network infrastructure from operations, it's an entirely new way to organise and manage railway systems. Some suggest that this separation should go as far as in road transports or aviation, i.e. to separate the system in the three levels of network maintenance, network operation and train operation. The discussion presented in this paper shows that such an organisation would not better support the non-discrimination objectives, but would create additional boundaries.

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