Rail freight

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This is an Accepted Manuscript of a book chapter published by Routledge in The Routledge Handbook of Transport Economics, on 4 August 2017, available online:

http://www.routledge.com/9781138847491

Chapter 23: Rail freight economics

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23.1 Introduction

Rail freight is generally viewed positively in terms of its contribution to society and the environment but is often seen as uneconomic by those requiring the use of freight transport services. While it is often possible to ascertain the cost side of rail freight transport, it is more challenging to identify the pricing policies due to a lack of transparency and commercial confidentiality concerns. As a rule, a higher proportion of rail freight's costs are 'fixed' when compared to road haulage. This leads to the oft-quoted maxim that rail is best suited to high volume flows over long distances, since lower unit costs can then be reflected in more competitive pricing. Not surprisingly, given the variance in the characteristics of freight transport markets and specific flows, there is a lack of agreement as to the necessary volume or distance for commercial viability. Furthermore, many aspects of the economics of rail freight activity are typically not transparent, so it is a challenging area about which to provide a detailed evidence-based account. That said, this chapter seeks to provide insight into the key characteristics of, and influences on, the economics of rail freight. It focuses mainly on rail freight economics from a European perspective and, in particular, the British situation. Rail freight activity is considered mostly within the context of a mixed traffic railway (i.e. 'shared-user' rail networks catering for both passenger and freight traffic), the dominant form of rail operations across Europe.

The chapter adopts a broad approach to examining the key factors influencing the economics of rail freight activity, starting with a general overview of the nature and structure of the rail freight cost base (Section 23.2) followed by an assessment of the economics of different types of rail freight operation (Section 23.3). Section 23.4 considers the important role of the public sector in influencing the economics of rail freight, with Section 23.5 discussing the attributes of competitive rail freight markets. The role of pricing in influencing companies' mode choice decision making is briefly considered in Section 23.6. A series of short case studies demonstrating rail freight's efficiency and cost-competitiveness is then presented (Section 23.7) and a brief summary of the key issues completes the chapter (Section 23.8).

23.2 Overview of the nature and structure of rail freight costs

Fundamentally, rail freight experiences high fixed costs and low variable costs when compared with road haulage, though how this manifests itself is somewhat dependent on the nature of the cost structure applied to the rail industry; the role of the public sector in determining this is assessed later in the chapter but, for now, the basic features of rail freight costs are established. Figure 23.1 presents the indicative relationship between fixed and variable costs. Before any rail freight activity can take place, expensive assets such as track, terminals, locomotives, rolling stock and skilled staff must be in place. A high proportion of the cost of these assets, particularly track and terminals, is fixed with little cost variability resulting from marginal changes in the level of activity.

Insert Figure 23.1 here

Another way of considering rail freight costs is in terms of the breakdown between infrastructure costs and train operating costs, which bears some similarities to the relationship between fixed and variable costs. Sometimes, the infrastructure and operating costs are integrated and considered holistically, particularly where rail infrastructure and train operations are operated by a single entity, typically a nationalised railway organisation or a private rail system dedicated to a particular type of traffic. Where rail infrastructure is provided exclusively for freight activity, all infrastructure and train operating costs quite clearly are the responsibility of the freight operation. In some cases, particularly for bulk commodity flows (e.g. the Sishen-Saldanha corridor for iron ore exports in South Africa and the rail systems carrying coal for export through the Port of Gladstone in Australia), entire routes or even networks are dedicated to freight activity. The allocation of common network costs to rail freight activity is more challenging on a mixed traffic railway, prevalent in most European countries, and allocation to specific rail freight flows or customers is more difficult still.

It is increasingly the case across Europe that rail infrastructure is the responsibility of a nationalised infrastructure provider (often referred to as the infrastructure manager (IM)) while rail freight services are provided by one or more rail freight operator who may be from either the private sector or the public sector. In these circumstances, the infrastructure and train operating costs tend to be treated separately. Where the necessary infrastructure is not already in place to commence rail freight operations, the capital costs of providing track, terminals and signalling are high, so a guaranteed rail freight volume over a considerable time period is usually needed in order to present a viable business case. Where this is not possible, public funding may be available to take account of wider economic, environmental and societal benefits (see Section 23.4). A high profile European example is the Betuweroute, a dedicated 160 kilometre rail freight link from Rotterdam to the German border, opened in 2007 and funded by the public sector.

The actual movement cost by rail (on a tonne-kilometre basis) is often cheaper than by road, but the door-to-door comparison between rail and road may be less favourable to rail because of terminal handling costs and feeder road costs. In simple terms, road normally offers a cheaper option than rail for short distance and/or low volume flows, while rail becomes more competitive as distance and/or volume increases. In particular, the concept of a break-even distance features strongly in the rail freight literature. There is no consensus as to the break-even distance beyond which rail becomes cheaper than road. Harris & McIntosh (2003) argued that rail is unlikely to be cost-competitive over distances of less than 100 miles (i.e. 160 kilometres), while recent research for the European Commission found that 200 - 300 kilometres is the typical range at which rail starts to be favoured over road (Directorate General for Internal Policies, 2015). Figure 23.2 conceptualises the relationship between road and rail costs (and prices), identifying a critical distance range within which the two modes tend to compete.

Insert Figure 23.2 here

Table 23.1 presents findings from the 2012 Freight Customer Survey (ORR, 2012), where respondents were asked their opinion on the distance at which rail freight becomes competitive. Surprisingly, given the typical break-even distances quoted in the literature, 38% of respondents believed rail to be competitive over distances of 100 miles or less and just 12% thought distances in excess of 200 miles were needed. As will be seen later in the chapter (see Section 23.7), rail freight flows over short distances can be viable given appropriate circumstances.

Insert Table 23.1 here

In reality, the rail haulage cost profile is likely to be more 'lumpy' (i.e. less linear) than that for road as distance or volume increases. As also highlighted in chapter 25 on intermodal economics, when the maximum train payload is reached, an additional train is needed to cater for any more volume. This will require another locomotive, representing a steep cost increase. It is much easier to keep on adding incremental capacity in road haulage, since each extra lorry marks a small capacity increase compared to the capacity offered by an additional train. Similarly, with respect to distance, costs are likely to be more stepped for rail because of asset requirements and utilisation (e.g. if the round trip time becomes longer then an additional train may be required to offer a specific service frequency). Therefore, even within the critical range, there may be points where the cheaper mode of transport is inverted, with rail being cheaper for specific volumes or distances rather than across a range.

In general, then, rail freight costs are not as predictable and are less transparent than road haulage costs due to the more complex rail cost base and, in a competitive market, concerns over commercial sensitivities (DfT, 2009). In particular, the capital costs of developing new infrastructure such as track and terminals where they do not already exist can be a major obstacle to financial viability. The link between costs and pricing is rarely obvious, in the public domain at least. The standard practice is to charge as much as the market will bear since, for reasons outlined already, much of the cost base is indivisible to a specific commodity flow or customer level, particularly where infrastructure, rolling stock and/or labour is shared. The greater the train payload (in weight and/or volumetric terms) and distance and the simpler the method of operation, the more favourable the economics are for rail movement. However, there are many factors which influence the outcome and the next section considers these within the framework of different types of rail freight operation.

23.3 Economics of different types of rail freight operation

There are various ways in which rail freight activity can be categorised, with the nature of operation having a considerable influence on the economics. The key differences can be summarised using the following categorisation (Woodburn, 2015):

1. Trainload operation, where the entire train operates from origin to destination in a single block, is typically the most economic form of rail freight activity, particularly where the trainload makes use of rail's heavy haul capabilities. In most cases, one commodity type (e.g. coal, steel, construction materials) will be carried for a single customer, but there are other types of trainload operation (e.g. of containers) carrying different types of goods for a range of customers.
2. Wagonload provision, where trunk trains connect hub marshalling yards with each other and feeder trains operate on 'spokes' from the hubs to customers' terminals. Trunk trains usually carry a mix of commodities and/or serve a range of customers, while feeder services typically serve an individual customer or multiple co-located customers. Wagonload operation typically results in a wagon being re-marshalled several times on its journey from origin to destination.
3. Block wagonload, which is basically an intermediate solution between trainload and wagonload. A small number of train portions (or blocks of wagons) are combined for movement in complete train loads, with portions being exchanged at fewer intermediate marshalling yards than would normally be the case with wagonload operation.

Figure 23.3 shows examples of trainload and wagonload operation. The upper photograph is a British example showing an entire train of hopper wagons (for construction materials) running directly between two terminals. The lower photograph is a wagonload train in the Czech Republic, with several different wagon types (including boxes, tanks and hoppers) clearly visible. It is likely that the train comprises wagons for a number of customers and with flows from a wide range of origin-destination pairs. Such wagonload operation results in higher operating costs per wagon as a consequence of the additional marshalling of wagons at intermediate locations and the typically poor load utilisation of the feeder services. There are also likely to be indirect cost implications since, for example, the end-to-end journey time is typically much longer for indirect wagonload operation than for direct trainload services, leading to poorer wagon utilisation.

Insert Figure 23.3 here

As Table 23.2 reveals, the overwhelming majority of British rail freight activity is trainload in nature. The remainder can justifiably be classified as block wagonload, since there is no true wagonload rail freight remaining; it is now extremely rare for a freight train to convey portions for more than two or three different flows. The challenging economics for wagonload operation were highlighted in 1990 when British Rail reviewed the 'Speedlink' wagonload network and found it to be hugely unprofitable (Shannon, 2014). In consequence, this network was disbanded in 1991 with traffic lost to rail, switched to trainload operation or, in relatively few cases where small volume flows could be combined, retained as block wagonload.

Insert Table 23.2 here

To add to the distance and volume characteristics discussed in Section 23.2, the economics of rail freight are improved when customer requirements are predictable and regular, since this smooths the utilisation of expensive assets. Trainload flows tend only to operate when the customer has sufficient volume to justify this, since the customer will generally be responsible for the train's operating costs. If the flow operates on a fixed day each week, the rail freight operator can potentially share its assets with other flows whereas if the flow's operating day varies it becomes much more difficult to schedule the assets efficiently. As a result, overall asset utilisation will fall and operating costs per tonne kilometre will most likely increase.

Table 23.3 presents a hypothetical example of a medium-volume flow, identifying pros and cons associated with each of three potential service options. It is assumed that a customer has a flow of 1,000 tonnes of product per week to be moved over a distance of 500 kilometres from a single origin to a single destination. This weekly tonnage requires twenty wagon loads. Pros and cons associated with three potential service options are shown in Table 23.3. It is evident that the most cost-effective transport solution will depend on the particular characteristics of the flow and the extent to which it is operated in conjunction with other traffic. For example, the single dedicated trainload per week is likely to be the most cost-effective option in terms of direct rail costs, particularly if the assets can be inter-worked with other flows. However, this has to be traded off against wider logistics considerations such as likely increased inventory costs associated with receiving an entire week's worth of inventory in a single trainload rather than in smaller, more frequent, quantities.

Insert Table 23.3 here

23.4 Public sector influences on rail freight economics

The role of the public sector in influencing rail freight economics is complex and dynamic, but of considerable importance. This section first sets out why rail freight is of wider importance to society and the economy, leading to the economic rationale for government intervention in its economic structure. Examples of interventions made by the British government are then elaborated, followed by a discussion of the broader European context.

23.4.1 The importance of rail freight to society and the economy

Despite having a fairly minor share of the overall British freight market, at around 9% in 2013 (ORR, 2015), it is evident that rail freight performs a valuable economic function to society and the national economy. Studies produced by Network Rail (2010, 2013), Oxera

(2014) and the Rail Delivery Group (2014) have claimed a range of benefits resulting from the existence of the rail freight industry, including:

- A reduction in road network congestion
- Increased economic output resulting from lower transport costs
- Savings in social and environmental costs

The Rail Delivery Group (2015) estimated that goods worth more than £30 billion are moved by rail annually in Britain with the rail freight sector cumulatively benefiting the British economy by around £1.5 billion each year, two-thirds of that directly to its customers and the remainder to society as a whole. Given rail freight's economic strengths relative to road haulage, some sectors of the economy rely heavily on rail for their transport requirements and would not efficiently function without it. This is particularly true for raw materials and part-finished goods in the early stages of the supply chain, but rail has increasingly become a crucial element in later supply chain stages moving, for example, imported consumer goods. Some examples of viable rail freight flows of consumer goods are identified in Section 23.7.

As with freight transport in general, rail freight activity is a derived demand, with overall levels of activity linked to the economic cycle. According to the Directorate General for Internal Policies (2015, 3), structural changes to the European economy, including "changes in the industrial production process and the fragmentation of logistics" have had negative impacts on rail freight. Specifically, rail-dominated bulk flows such as coal, construction materials, iron ore and part-finished steel are more susceptible to decline during economic downturns than are many of the road-dominated flows such as essential consumer goods (e.g. food and drink products). With fixed costs making up a high proportion of rail freight's cost base, and thus a very high break even point, financial viability is more challenging during an economic downturn since the fixed costs are more heavily concentrated on the remaining flows.

23.4.2 Examples of government intervention in British rail freight economics

Government intervention principally relates to the charging regime and to the provision of public funding, and can involve either direct action through the regulatory framework or can result from more general policy direction. Examples of intervention in Britain include the regulatory framework governing network access and charging, grant funding for infrastructure and service provision and broader land use planning policies relating to issues such as terminal development. It is important for government to provide policy continuity to give confidence to rail freight operators and their customers to invest private capital into rail freight terminals and rolling stock.

Rail operations typically are more heavily regulated than road haulage operations, which can impose a financial burden to the operator but should also provide fairness and transparency within the market. Since the privatisation of British Rail in the mid-1990s, certain cost elements which contribute to the total rail freight economic package fall within the remit of the Office of Rail and Road (ORR, prior to 2015 the Office of Rail Regulation), particularly relating to the regulatory framework. ORR is the independent economic regulator for the British rail network (ORR, 2016), with a remit to ensure that all operators are treated in a non-discriminatory manner so long as network access licensing requirements are met (see Chapter 7 for more detail on this). Financial fairness and transparency are vital to satisfying this remit. Specific economic functions of ORR include:

- Promoting competition in the provision of railway services
- Ensuring value for money and protecting the interests of rail users

- Establishing the level and structure of track access charges
- Conducting investigations into practices which may be anti-competitive
- Regulating Network Rail, the monopoly infrastructure provider, including target setting and monitoring for performance and efficiency.

Rail freight track access charges are determined every five years as part of ORR's funding settlement for Network Rail. This provides certainty for rail freight operators for that time period but creates uncertainty at the time of each review (Network Rail, 2014). The 2008 review led to a 35% reduction in track access charges for the 2009-2014 period but also introduced a 'freight only line' charge for power station coal and nuclear waste. After considerable uncertainty, the 2013 review resulted in a phased increase in access charges for traffic considered to be captive to rail (i.e. power station coal, nuclear traffic and iron ore), slight increases in access charges for other bulk commodities and a real terms reduction for the cost-sensitive intermodal traffic. The effects of track access charges on freight volumes are dependent on modal competition in specific markets. In 2006, track access charges were estimated to represent 17% of the total rail freight cost (MDS Transmodal, 2006). It was estimated that a uniform 50% increase in track access charges would lead to a 9.2% decrease in overall rail freight volumes, but certain markets including intermodal and construction materials would be much more significantly affected.

A specific challenge where rail infrastructure is publicly owned and freight train operations are in private hands is the potential for non-aligned objectives and a lack of synergy between the various industry players. A Freight Alliance has been formed between Network Rail and the main rail freight operators to try to achieve cost savings across the whole industry and to develop a sustainable access charging regime for freight which gives long-term stability (Network Rail, 2014).

While the level at which track access charges are set will influence rail's ability to compete with road haulage on cost grounds, more targeted government funding may be available to support rail freight flows where they are otherwise not commercially viable. Direct rail freight grant funding in Great Britain has mainly taken the form of capital support for assets such as terminal equipment or rolling stock and revenue support for moving freight by rail rather than road. The Mode Shift Revenue Support (MSRS) Scheme is a component of the Sustainable Distribution Fund (SDF) has been the main funding source in recent years, with capital support in the form of the Freight Facilities Grant (FFG) now available only in Scotland and Wales (DfT, 2015). To be eligible for funding, schemes require a Benefit Cost Ratio of 2:1 or more. Almost £90 million of grant funding was awarded between 2010 and 2015, although a small proportion of this total was awarded to waterborne traffic; a slightly reduced level of funding has been allocated for the 2016-2020 period (DfT, 2016).

Infrastructure enhancements to permit heavier trains, such as higher permissible axle loadings, can improve the economics of bulk flows. Of more significance for much of the traffic where rail competes directly with road, particularly lighter-weight consumer goods carried in unit loads, is network capability for longer, higher and wider trains (RFG/RFOA, 2009a). Public funding for initiatives aimed at improving the efficiency and competitiveness of rail freight include the Strategic Freight Network (SFN), the Freight Reform Programme (FRP) and more general funding for network enhancements (Network Rail, 2014). The SFN was initiated in 2007 to coordinate infrastructure enhancements for freight, evolving out of the short-lived Transport Innovation Fund (Productivity) (TIF(P)) which had set out to prioritise network enhancements which would benefit national productivity. Specifically, the SFN aims to "provide an enhanced core freight trunk network, optimised to freight requirements, and providing greater capability, reliability and availability" (DfT, 2007, 81). Around £50 million annually has been allocated to the SFN for the 2009-2019 period.

Across the transport sector, changes to the regulatory and policy framework for the different modes of freight transport can influence the competitiveness of rail freight. For example, a detailed study of the likely impacts of allowing longer and/or longer and heavier goods vehicles (LHVs) to operate on the road network found that the economics of key rail freight markets could be undermined by road haulage becoming cheaper (TRL, 2008). Deep sea container and domestic intermodal markets are particularly vulnerable to increases in the maximum length of lorries, with bulk markets more likely to be affected by increases in weight limits.

Indirectly, other government policies can have an effect on the rail freight market and, as a consequence, its economic performance. For example, policies relating to energy generation can have major impacts on rail freight activity. The 62% decline in coal volumes, traditionally rail freight’s biggest commodity flow in Britain, between 2014/15 Q2 and 2015/16 Q2 (ORR, 2015) has caused considerable concern about the financial viability of the entire rail freight sector. This dramatic decline in coal traffic has resulted from the introduction of a new tax on coal in the 2015/16 financial year, the closure of power stations as they reach their agreed generating limits and the decision to phase out electricity generation from coal by 2025. All of these factors, which have led to instability in the rail freight market, result from the implementation of public policies designed to limit the effects of climate change.

23.4.3 The European dimension

The British experience fits within the wider regulatory and operational framework governing the economics of rail freight at the European level. Since 1990, the European Commission has been developing its rail policies with the broad aim of improving rail efficiency and competitiveness through liberalisation and harmonisation (see Butcher (2013) for a concise summary). Progress has been widely regarded as being slow, though there have been some major changes influencing the economics of European rail freight in the intervening 25 years. Key measures include:

- The First Railway Package established the open access principle for international rail freight;
- The Second Railway Package focused on the subsequent liberalisation of national freight markets together with general interoperability measures to better integrate the European rail system;
- A range of additional agreements to enhance interoperability and improve the performance of European rail freight.

The overall aim is the creation of a Single European Railway Area, with harmonised regulations (e.g. for the approvals processes for new operators or rolling stock) and the legal, financial and operational segregation of infrastructure and service provision so as to engender a more efficient and competitive rail freight market. Particular challenges remain for cross-border freight train operations, especially where infrastructural differences such as track gauge or electrification voltages prevail. Traditionally, this has led to increased cost and transit time as a consequence of having to transship consignments between wagons with different gauges or to change locomotives to match the supplied electrification system. There are two main ways of overcoming such issues, with differing economic implications:

- Standardise the infrastructure across Europe (e.g. with a common track gauge and electrification system): to do this continent-wide, even just for core routes, would require up-front capital investment, most likely publicly-funded, but would lead to lower train operating costs (unless the capital investment was recouped through higher track access charges). Most new strategic rail infrastructure is constructed to a standardised track gauge and with a common electrification system, but there remains the legacy effect of long-established non-standard infrastructure.

- Utilise equipment that can overcome infrastructure differences: technological advances have allowed the introduction of gauge changers which can re-gauge rolling stock axles where there is a change in track gauge (e.g. on the France-Spain border) and multi-voltage locomotives which can draw power from two or more electrification systems. The costs of adopting these technologies are more likely to be borne by rail freight operators themselves and, particularly with multi-voltage locomotives, will be an ongoing additional cost in terms of higher leasing or purchase costs because these locomotives are more complex and thus more expensive to provide. However, these additional costs may be outweighed by cost savings resulting from better locomotive utilisation resulting from using the same locomotive over a greater distance and not having to keep locomotives on hand at the location where the electrification system changes. An alternative solution is to use diesel rather than electric traction, but this may not be desirable for economic or environmental reasons.

International Rail Freight Corridors (RFCs) are being implemented to simplify the operation of long-distance freight trains, improving efficiency and reducing costs, with the aim of making rail more competitive.

23.5 Competitive rail freight markets

Given the foregoing discussion concerning the role of the public sector, at both the British and European levels, it is evident that rail freight does not operate in an unconstrained free market environment. However, over the last two decades, intra-rail competition has developed as a consequence of the liberalisation policies already outlined. In this section, the effects of competition and its principal positive and negative influences on rail freight economics are set out. Based on data from the IBM Rail Liberalisation Index, it appears that market liberalisation generally leads to a growth in rail freight market share but does not necessarily guarantee this (CERRE, 2014). Figure 23.4 demonstrates the gradual opening up to competition of the British rail freight market since British Rail was privatised in the mid-1990s. It is evident that EWS had a near-monopoly in the late-1990s but its share of the market has been eroded over time. In 1997, EWS and Freightliner had non-overlapping rail freight activities, with EWS monopolising all markets except for the intermodal market which was the preserve of Freightliner. Over time, these two operators have directly competed in each other's traditional markets and the new operators have made inroads into certain areas of these markets. Table 23.4 shows the level of competition within the different freight markets by early-2013. There is a clear relationship between operator size and the number of markets in which they are active, with DB Cargo UK (formerly DB Schenker (DBS) and, before that, English, Welsh and Scottish Railway (EWS)) and Freightliner having the strongest representation. Even at this level of disaggregation, what appear to be competitive markets may not be so. In the intermodal market in 2013, for example, DB Cargo UK, Freightliner and GB Railfreight were all competing in the port-hinterland containers sub-market, while DRS had a near-monopoly of the domestic intermodal sub-market.

Insert Table 23.4 here

It is important to note, though, that there is often competitive tendering to gain contracts, so the absence of multiple operators does not necessarily imply a lack of market competition. There have been examples of contracts changing from one operator to another, and of customers splitting their traffic requirements among two or more operators. Examples include operator changes in the Anglo-Scottish domestic intermodal market (see Section 23.7) as contracts have been re-tendered and Tarmac awarding new five-year contracts to four of the rail freight operators in early-2016, with each operator taking responsibility for a specific part of the company's requirements (Tarmac, 2016). Given the commercial sensitivities involved, however, the role of pricing relative to other attributes such as service quality and performance (see Section 23.6) in these contract changes tends not to be publicised.

Considering the British rail freight market in its entirety, there is substantial evidence of efficiency improvements in recent years. Comparing official data on tonnes lifted and the number of freight trains operated reveals a large increase in the average freight train payload, though not in a straightforward linear manner. In 2003/04, the average tonnage per train was 214 tonnes; by 2014/15 this had increased by more than 80% to 391 tonnes (ORR, 2015). The specific numbers need to be treated with some caution, since the two variables are not recorded in the same way, but the overall trend towards heavier average payloads is clear.

Insert Table 23.5 here

The rail freight operators have invested more than £2 billion in locomotives, wagons and capital equipment since the mid-1990s (Rail Delivery Group, 2015), with considerable efficiency improvements to be seen. The Rail Value for Money Study (DfT/ORR, 2011) found that staff efficiency had dramatically improved for rail freight but not for passenger rail (see Figure 23.5).

Insert Figure 23.5 here

While a competitive market may lead to a focus on cost efficiencies, innovation and investment in order that operators remain (or become) competitive and win contracts, there can be economic downsides. A competitive rail freight market tends to lead to low operating margins and limited options for operators to respond quickly to changing market conditions because of their high fixed cost base. The high fixed costs and the regulatory requirements can also represent a significant barrier to new entrants. In the British market, the economic downturn in 2008/09 generally reduced margins with two of the four largest operators recording losses and two other operators having gone out of business (DfT/ORR, 2011). Similar concerns have been raised more recently in light of the dramatic decline of the coal market (see Section 23.4.2). A more general potential economic downside of a competitive market relates to the potential loss of economies of scale, which may lead to inefficient resource utilisation or the loss of marginal flows. The tendency for competing operators to focus on the more profitable and straightforward trainload flows may jeopardise the continued provision of wagonload services. Furthermore, the susceptibility to downturns as part of the economic cycle leads to high risk, which may deter market entrants due to generally insufficient returns.

23.6 Importance of rail freight pricing in mode choice decision making

Based on a survey of British rail freight customers (ORR, 2012), Table 23.6 compares perceptions of the performance and the importance of a range of service attributes. This reveals a major discrepancy between the importance of rail freight cost/price (ranked 1) and its perceived performance (ranked 13).

Insert Table 23.6 here

In some markets, particularly for higher value commodities such as consumer goods, journey time can have a considerable monetary value. Based on ORR data, the value of journey time to the customer of a deep-sea container train was estimated as £1,069 per hour (DfT/ORR, 2011), meaning that some customers may be willing to pay more for shorter transit times. European research has emphasised that shippers' modal preferences generally include service quality factors (e.g. reliability, capacity) in addition to cost/price (Directorate General for Internal Policies, 2015). Even when rail is well-placed to offer a cost-competitive modal option, the greater complexity for rail freight operators compared with road hauliers may place rail at a disadvantage:

> "It is common practice to obtain a price and service details within 24 hours from asking for information from a road haulier. This is not as easy in the rail sector as applications have to be made to the network manager and checks made on the availability of train paths and types of wagon required. This tends to delay the process and may even not be provided in time for a potential customer. Even when prices and service details are known there is the possibility there might not be a suitable terminal close enough to the destination." (DfT, 2010b, 3)

23.7 Making rail freight more efficient and cost-competitive: British case studies

By using a range of practical examples from the published literature and original research, this final section attempts to provide a flavour of how rail freight can become more cost-competitive, particularly in the face of competition from road haulage.

23.7.1 Short distance rail freight flows

It is generally challenging to obtain financial information relating to specific flows or customers owing to commercial sensitivities, but a Freight Best Practice Case Study (DfT, 2010b) provided details of a relatively short distance (72 miles/116 kilometres) cement flow in Scotland to be commercially viable. Each train conveys the equivalent payload of 37 lorries, with consequent savings in labour and fuel costs making a flow over even this distance commercially viable. The amount of fuel needed for the rail flow is just one-third of that if the flow were to be carried by road. Key to rail's viability is the long-established rail terminal infrastructure at both the cement works and the receiving terminal, keeping capital costs down. Had the terminals not already existed, though, government grant funding may well have been available to help to defray up-front capital costs.

23.7.2 The growth of rail for domestic flows of consumer goods

Since 2000, rail has become considerably more active in carrying consumer goods in unit loads such as containers. In particular, the number of services between the Midlands (especially the Daventry terminal) and central Scotland has increased to 5 or 6 per day in each direction. In a study to emphasise rail's potential, the FTA (2012) summarised the growing use of domestic intermodal rail freight services on this corridor contracted by logistics service providers and carrying loads for key retailers including Tesco, Morrisons, Marks and Spencer, Sainsbury's, Asda and The Co-Operative Group. Tesco is unique in providing trainload volumes, with the other retailers making use of shared-user trains. A number of the retailers have reported cost savings over the road haulage alternative, making rail freight financially viable as well as more sustainable. In many cases, these consumer good flows benefit from the MSRS grant funding discussed in Section 23.4.2. Broader service improvements (e.g. greater service frequency and flexibility, improved responsiveness to customer requirements, additional terminals) are needed to achieve a greater volume shift to rail. The challenge of aggregating sufficient volume from across the customer base to make up sufficient trainload quantities for new routes was also identified as an obstacle to be overcome, reflecting the high fixed costs of freight train operations.

23.7.3 Improved network capability for port-hinterland container traffic

As a result of government funding from sources including TIF(P) and SFN (see Section 23.4.2), many corridors have witnessed improvements in capabilities for train length and weight, benefiting on-train capacity and helping to reduce unit costs. Much of the attention has focused on enhancing infrastructure for port-hinterland container flows, with a gauge enhancement programme increasing the network coverage for high cube containers to be carried on standard wagons and targeted infrastructure improvements allowing longer container trains to operate. In addition, rail freight operators have invested in new locomotives and wagons that also help to improve efficiency in this key rail freight market. Table 23.7 demonstrates considerable improvements in efficiency between 2007 and 2015, resulting in a 25% increase in the typical train load (as measured in twenty-foot equivalent units (TEUs)). With one-quarter more containers being moved by broadly the same number of train services per week (578 in 2007 and 579 in 2015), and given the relatively high fixed costs of freight train operation, it is likely that the TEU cost per kilometre will have reduced.

Insert Table 23.7 here

23.7.4 New dedicated rail freight infrastructure

The North Doncaster Chord (in Yorkshire, northern England) is a 3.2 kilometre section of new railway line which was opened in June 2014. It provides a more direct route for imported coal (and now biomass) traffic from the port of Immingham, on Britain’s east coast, to the three large power stations in the Aire Valley. Prior to its opening, the majority of these freight trains had to share a 22 kilometre section of the East Coast Main Line with express passenger services. The new Chord has helped to segregate the intensive passenger and freight flows, aiming to improve the performance of both and to provide additional network capacity to cater for growth in service provision. A 'before' and 'after' analysis (conducted by the author) of freight train performance revealed reductions in both average journey distance and average scheduled journey time of almost 10% and a considerable increase in on-time arrivals at the power stations (up from 83% to 89% of trains arriving less than 10 minutes late). Improvements in these measures are likely to offer opportunities for cost reduction for rail freight operators through reduced fuel costs and improvements in the utilisation of staff, locomotives and wagons.

23.8 Summary

The link between costs and pricing within the rail freight market is not especially clear, so it is quite challenging to develop a strong understanding of the economic structure. Rail is particularly well-suited to handling trainload volumes of bulk goods, but often struggles to achieve commercial viability in smaller volume and/or short distance flows of goods such as consumer products. Increasing intra-modal competition, combined with considerable investment in modern equipment, has resulted in substantial efficiency improvements in the British rail freight market over the last couple of decades and growth in rail's share of non-bulk markets such as port-hinterland container traffic and domestic intermodal flows for major retailers. At the European level, measures are being implemented to try to create a Single European Railway Area in which intra-modal competition is encouraged and barriers to efficient operation are removed.

In some cases, the commercial viability of rail freight is dependent on public funding to develop infrastructure or support service provision, particularly where wider benefits to the economy, environment and society can be achieved by switching flows from road to rail. Overall, the chapter has demonstrated the critical role of the public sector in determining both the economic structure of the rail freight market itself and the ways in which rail is able to compete with other transport modes (especially road haulage). While challenges remain, there are encouraging signs of rail freight becoming more efficient and commercially viable despite the inherent characteristics which lead to a high fixed cost base in comparison with road haulage.

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Figure 23.1: Indicative relationship of rail freight costs versus volume carried

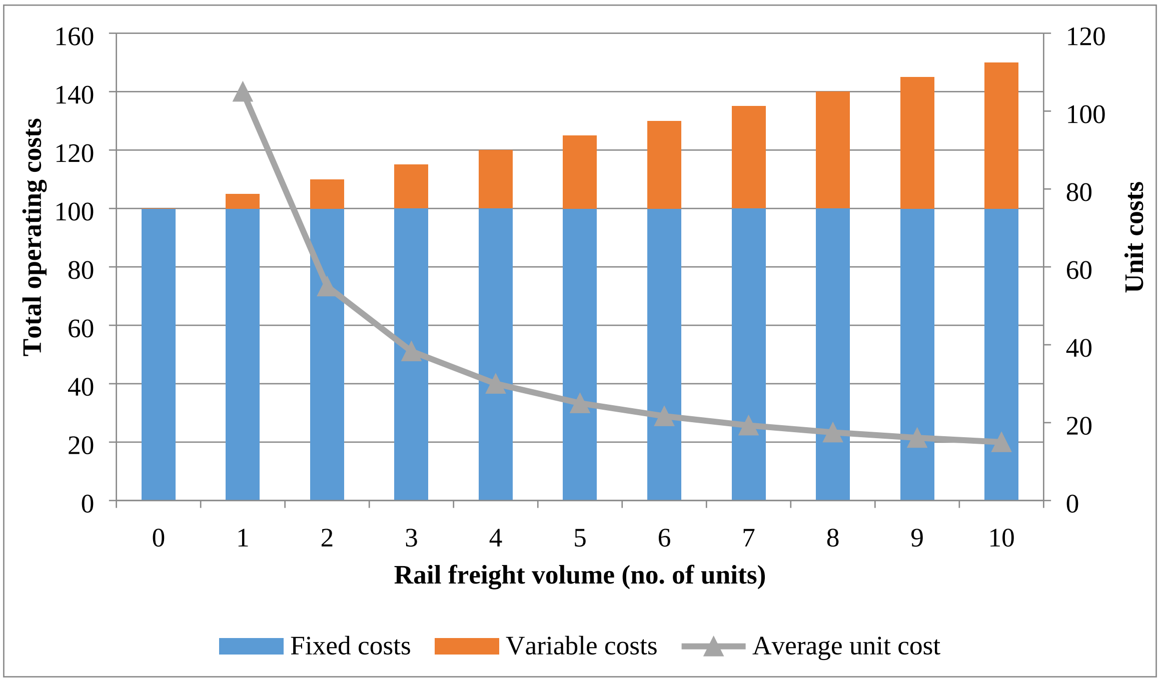
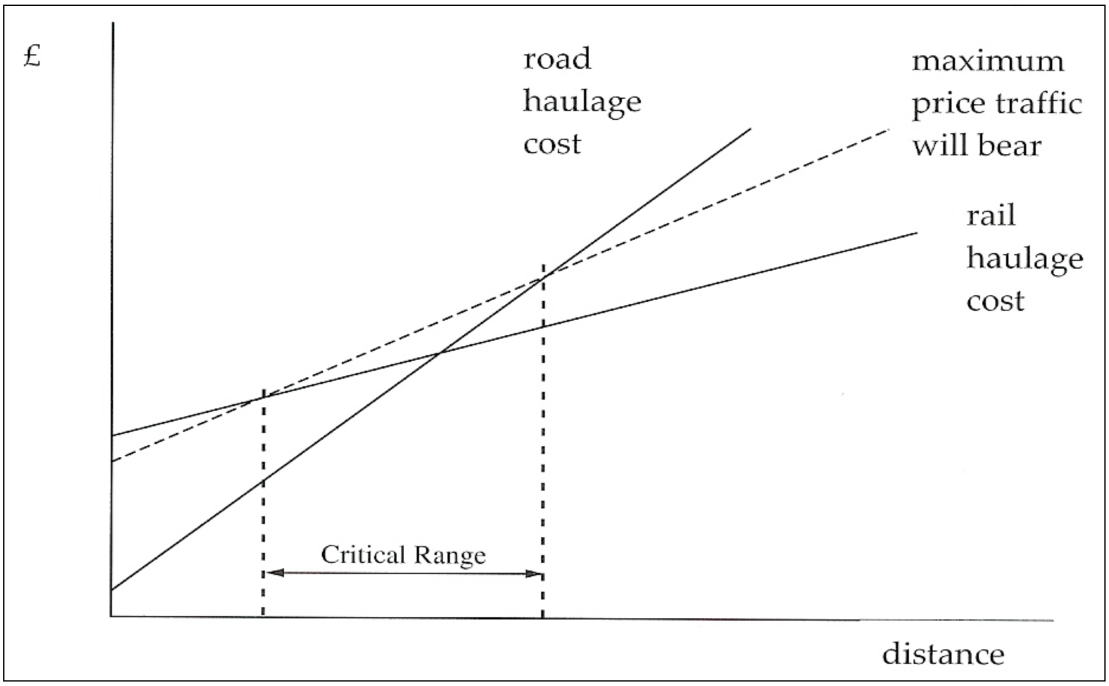


Figure 23.2: Relationship between modal costs and price by distance

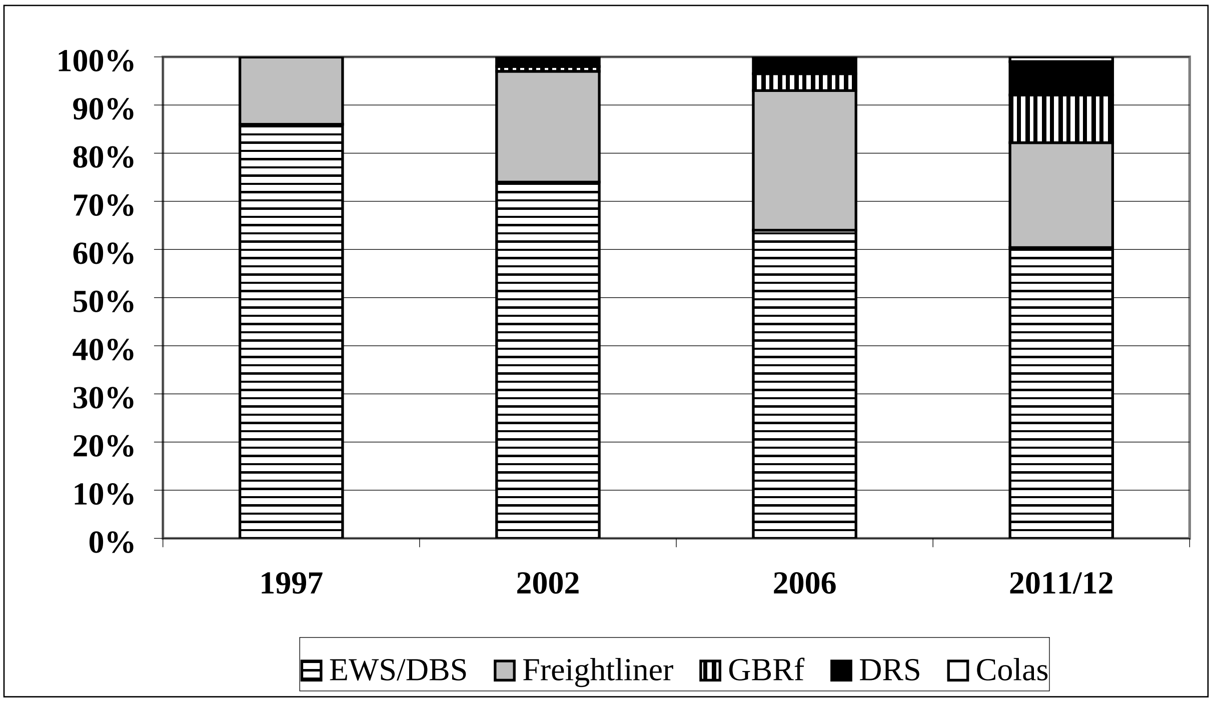


Source: Harris and McIntosh (2003)

Figure 23.3: Examples of trainload operation (upper) and wagonload operation (lower)

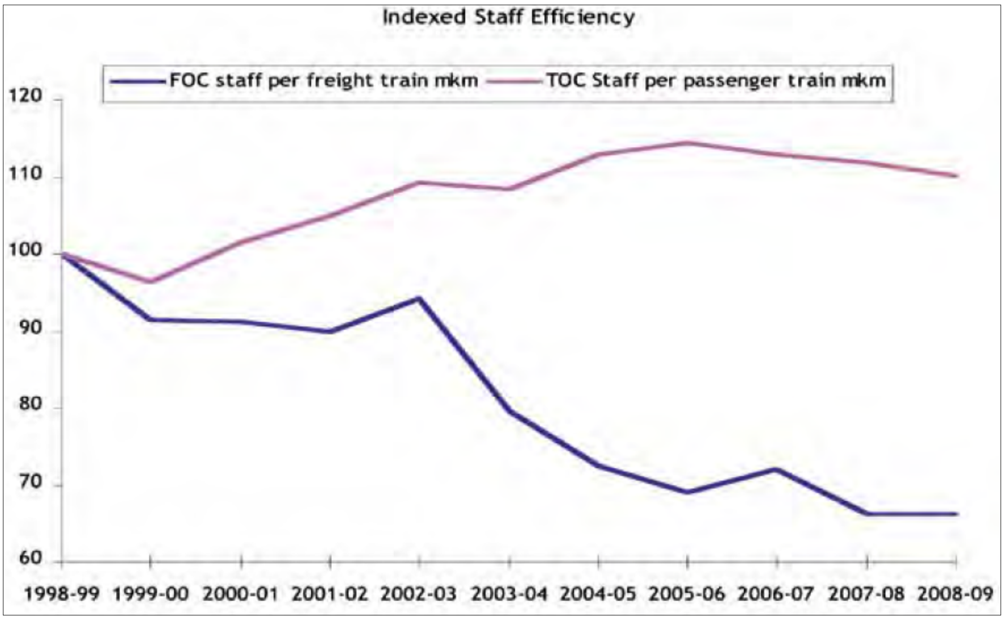
Source: Author

Figure 23.4: Estimated operator market share of British rail freight by revenue, 1997 – 2011/12



Source: Based on Railway Gazette International (2008) and ORR (2013)

Figure 23.5: Comparison of freight (FOC) and passenger (TOC) staff productivity (per train kilometre)



Source: DfT/ORR (2011)

Table 23.1: Distance at which rail freight becomes competitive

Distance in miles *(and km equivalent)*	**% of respondents (n = 48)**
0 – 25 *(0 – 40)*	2
26 – 50 *(42 – 80)*	13
51 – 100 *(82 – 161)*	23
101 – 150 *(163 – 241)*	29
151 – 200 *(243 – 322)*	21
201 – 250 *(323 – 402)*	6
> 251 *(> 404)*	6

Source: ORR (2012)

Table 23.2: Typical types of British rail freight operation, by market (as at January 2016)

Market	**Trainload**	**Block wagonload**
Coal	***	-
Aggregates	***	-
Metals	***	*
Petroleum	***	-
Automotive	**	**
Waste	***	-
Intermodal freight	***	*
Channel Tunnel	**	*
General freight	**	**

Source: Based on and updated from DfT (2010a); *** considerable use; ** moderate use; * limited use; - no (or virtually no) use

Table 23.3: Comparative positive and negative attributes of different service options

Option	Positive aspects	Negative aspects
One dedicated 20 wagon trainload per week	- Efficient use of rail's bulk haulage capabilities, with low cost per tonne-km	- Poor asset utilisation unless resources (e.g. wagons, locomotives, labour) are shared with other flows - Greater volume of goods to be handled and stored per delivery, with possible time and cost implications
Two dedicated 10 wagon trainloads per week	- Smaller number of wagons required than for weekly service if same wagons can do both weekly round trips - Shorter terminal time needed to load/unload 10 wagons than 20	- Duplicated costs (e.g. fuel, labour) from operating two weekly trains rather than one
Four wagons per day, five days per week on shared-user services	- Some or all of train operating costs shared with other flows - Possible further improvement in wagon utilisation and reduction in terminal time compared with trainload operation	- Additional costs for wagon marshalling and dedicated feeder services if shared-user services do not directly serve same origin and destination.

Table 23.4: Indicative level of competition in rail freight markets (as at January 2013)

	Rail freight operator					
Market	**Colas**	**DBS**	**DCR**	**DRS**	**FL**	**GBRf**
Coal	○	●	-	-	●	●
Aggregates	-	●	○	-	●	○
Metals	○	●	○	-	○	○
Petroleum	○	●	-	-	-	○
Automotive	-	●	-	-	-	-
Waste	-	●	-	-	●	●
Intermodal	-	●	-	●	●	●
Channel Tunnel	-	●	-	-	-	○
General freight	○	●	-	○	●	-

Source: Author's database; ● highly active; ○ slightly active; - not active

Table 23.5: Average freight train load (2003/04 – 2014/15)

Year	**Total no. of freight train movements**	**Freight lifted (million tonnes)**	**Average freight train load (tonnes)**
2003/04	416,053	88.9	214
2004/05	381,965	100.9	264
2005/06	455,561	105.3	231
2006/07	364,949	108.2	296
2007/08	332,218	102.4	308
2008/09	316,684	102.7	324
2009/10	278,472	87.2	313
2010/11	265,559	89.9	339
2011/12	273,897	101.7	371
2012/13	275,827	113.1	410
2013/14	288,371	116.6	404
2014/15	282,304	110.5	391
% change 2003/04-2014/15	(32)	24	83

Source: Based on ORR (2015)

Table 23.6: Ranking of perceived importance and performance of rail freight service attributes

Importance rank	Performance rank	Service attribute	Mean importance score	Mean performance score
1	13	Cost/price	8.91	5.52
2	4	Service quality – on time/punctual delivery	8.33	6.50
3	9	Access to mainline network	8.11	5.86
4	3	Overall service quality	7.86	6.55
5	8	Access to terminals	7.70	6.04
6	17	Flexible service/recovery strategy	7.66	5.24
7	12	Information/responsiveness to customer needs	7.52	5.55
8	7	Service quality – lead times	7.35	6.04
9	10	Location of logistics hubs	7.18	5.69
10	6	Service quality – journey time	6.84	6.30
11	2	Security of goods in transit	6.73	6.95
12	5	Equipment quality	6.58	6.35
13	1	Environmental considerations	6.35	7.71
14	11	Rail freight experience/past track record	5.73	5.61
15	15	Physical nature of goods	5.56	5.45
16	16	Track and trace	5.18	5.29
-	14	Other	-	5.50

Source: Based on ORR (2012); mean scores on a scale of 1 to 10 where 1 is extremely poor and 10 is extremely good

Table 23.7: Changes in key rail efficiency measures in British port-hinterland container market, 2007-2015

Efficiency measure	2007 survey	2015 survey	% change
Mean TEU capacity provided per train	59.99	69.89	16.5
Mean capacity utilisation per train (% of TEU)	72.20	78.14	8.2
Mean TEU load per train	43.76	54.68	25.0

Source: Author’s surveys