Restructuring the Chinese Freight Railway: Two Scenarios

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Abstract

Twenty years of debate regarding the restructuring of the Chinese freight railway have failed to yield a consensus. Early policy statements favoring the creation of above-the-rail competition over a monopoly infrastructure – the "European" model of rail restructuring – have broadened into a lively policy and scholarly debate that includes as an alternative the division of the system into competing vertically integrated railways – the "Americas" model of restructuring. To date, however, there have been no tangible reform steps beyond organizational restructuring, the construction of new coal railroads, some with private-sector participation, and the introduction of scheduled service, especially for containers, between China and Europe. In this paper we argue in favor of the Americas model as a basis for restructuring and offer two alternative scenarios for the creation of multiple vertically integrated freight railways. Both plans enable competition between independent firms and routes for import/export traffic, one a southern, One Belt/One Road path, the other a northern path via the Trans-Siberian Railway.

Keywords: Freight railway, restructuring, competition, vertical separation, horizontal separation, China

JEL codes: L43, L92, O18, P31, R40

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1. Introduction: The importance of railway and railway reform to Chinese economy

The railway system has played a significant role in the economic development of China. This is because China's vast geographic size, difficult terrain, and weather conditions make the railway system one of the most reliable forms of transport. Railway transportation has long served as the primary mode of transportation in China, and with rapid economic development in recent decades, China has experienced soaring demands for railway transportation.[4] According to data from the National Railway Administration and the Ministry of Transport, rail freight volume in China was 3.33 billion metric tons in 2016, compared with 2.87 billion metric tons in 2006, and reached a peak of 3.97 billion metric tons in 2013. Similarly, the volume of railway passenger transport in China has increased to 1257.93 billion passenger kilometers in 2016, compared with 662.21 billion passenger kilometers in 2006.

Coal is the major primary energy fueling economic growth in China. As the economy and industry in China have expanded, the country's coal consumption has continued – until recently – to rise. Particularly, coal has been critical for China's fast-growing power sector, generating nearly 80% of electricity output. Since 1990, bulk goods and raw material movements (especially coal) have accounted for about 75% of total freight traffic. Moreover, the spatial mismatch between coal production areas (concentrated in the inland Northwest region) and consumption areas (concentrated in the distant coastal Southeast region) has fostered the emergence of dedicated coal rail transport corridors, like the Shuo-Huang Line, and created the need to transfer coal over long distances through a transit network. On the one hand, the railway accounts for about 60 percent of the coal transportation in China. On the other hand, coal traffic accounts for more than half of total rail freight, reaching over 2.3 billion tons in 2013. From 2000 to 2012, coal traffic by railway increased by 145.8%, and the average transportation distance of coal traffic by railways increased by 16.2%.[5]

There is some debate as to whether the declines in coal use in China in 2014, 2015, and 2016 are a signal that "peak coal" was reached in 2013 or is in the process of being reached in the next few years, as a result of the combination of slower macroeconomic growth (the "new normal"), an economic structure moving slowly from agriculture and manufacturing to services, pressures and commitments for improvements in environmental performance, the related growth of cleaner energy sources, and coal supply and transport constraints (Han, *et al.*, 2018; Tang, *et al.*, 2018). According to NBS 2018, the coal-fired power generation still has a significant effect on China's electricity market, accounting for 71.8 percent of the total power generation in 2017, even though China has limited some coal-fired power generation due to environment consideration (Liu*, et al.*, 2018). However, there seems to be no serious contention that coal use will continue to decline for the foreseeable future.

With the rapid development of the economy, the railway system in China has been going through a period of significant improvement and innovation. Rail investment has increased at a particularly rapid pace in recent years. According to the China Statistical Yearbook, the total length of national railways in operation has increased from 53,378 km in 1990 to 120,970 km in 2015, ranking second in the world,

[4] See, for example, Xie, *et al.* (2002); Wan and Liu (2009); and Wilkins and Zurawski (2014).
[5] See, for example, Xie, *et al.* (2002); Shealy and Dorian (2010); Peng (2011); Wang and Ducruet (2014); and Zhang and Hou (2016).

while the total length of high-speed railways in operation has reached 19,000 km, ranking first in the world and accounting for over 60% of the total length of high-speed railways in the world.[6]

In 2013, the One Belt One Road initiative, including the Silk Road Economic Belt and the New Maritime Silk Road, was announced. The Silk Road Economic Belt will mainly take shape along railway lines connecting western China to Europe via Central Asia, Iran, Turkey, the Balkans, and the Caucasus across the 11,000-kilometer-long Eurasian landmass. The introduction of new higher-speed trains and more direct lines is designed to have a positive effect on the Chinese economy, especially through faster delivery times. Besides, along with the implementation of the Silk Road Economic Belt, the government has announced other infrastructure investments, including high-speed rail construction, in China's western region, intended to promote prosperity there. The New Silk Road intercontinental railways are also designed to boost the trade between China and its trading partners which are connected by rail. Furthermore, the transportation infrastructure along this route is designed to play a significant role on the creation of a Eurasian "economic corridor".[7]

Within China, the well-known "transportation bottleneck" problem has long hampered the coal sector, especially with regard to the rail network (Rui et al. 2010). In previous years, coal producers could not always get access to rail transport due to the lack of infrastructure capacity. According to Fan (2009), the logistical costs of coal account for 30 percent to 60 percent of total cost for power-generating firms. Thus, the Chinese railway sector has remained in need of more investments in railway infrastructure construction, even though railroad fixed-asset investment in China has reached 3.58 trillion yuan during China's 12th Five-Year period. According to China's 13th Five-Year Plan, about 3.5 trillion yuan will be invested in Chinese railway infrastructure construction from 2016 to 2020. Unfortunately, at least up to the present, the dramatic expansion of the Chinese high-speed passenger rail system has not succeeded in attracting enough travelers to reduce the demand for traditional passenger trains and thus free up capacity on the overall system for more freight trains (Wu, *et al.*, 2014).

More broadly, the Chinese railways enjoy a high modal share for both passengers and freight and thus play a vital economic role. By the year 2010, passenger rail traffic in China represented about 35 percent of the national traffic over all transportation modes, while the freight rail traffic, even more striking, was about 55 percent of the national freight total (Ning, *et al.*, 2006). Both passenger and freight railways operate at capacity, suggesting the need for continued development and investment to support China's continued economic growth. World experience suggests that the most reliable way to address freight (especially) rail capacity constraints is to reform the state-owned monopoly system in such a way as to both attract private investment and, to the degree possible, create competition. Although it will be difficult, railway reform in China along these lines seems to be necessary.

The next part of the paper will present the world experience with railways restructuring. The following part will briefly present the experience with Chinese railway reform. The subsequent part will discuss the scholarly debates on railway reform. Parts five and six will focus on two proposals for possible Chinese freight railway reform models, followed by Conclusions.

[6] Ning, et al. (2006); Wilkins and Zurawski (2014); Xu and Jin (2016).

[7] Fallon (2015); Rolland (2015); Xu and Jin (2016); Li, *et al.* (2016).

2. The World Experience with Railways Restructuring

The decades of the 1990's and the 2000's were everywhere in the world periods of reform and privatization of infrastructure sectors in general and of the railways sector in particular (Gómez-Ibáñez and de Rus, 2006). As in other infrastructure sectors, railways reforms around the world have tended to focus both on the introduction of private-sector participation and on the possibilities for the creation of competition in the context of what has been traditionally considered a natural monopoly, historically owned and controlled by government. Also as in other infrastructure sectors, economists around the world have tended to favor the structural separation of vertically integrated infrastructure operators from service providers as a sort of default option – as the generally preferred method of restructuring to create competition among users of a network, in sectors as diverse as railways, electricity, telecommunications, and water. So, for example, reformers have urged the creation of competition among multiple electricity generation plants supplying power into a monopoly grid or, more recently, among multiple extractors and purifiers of drinking water into a common system of pipes (Newbery, 1999; Pittman, 2003, 2007a, 2007b; Xu, 2004).

The freight railways sector is one – not unlike landline telephones – where it is not always clear that users require competition within the narrow sector to be protected from the exercise of market power by their suppliers. Landline telephone service is faced with increasingly intense competition from mobile telephony – though of course there is not as much competition when the two services are provided by the same firm. For many freight shippers, motor carriers provide close competition to freight railroads, and for others the same may be true of water carriers and air carriers. However, there are certain classes of goods and transport services – especially bulk goods traveling over long distances – for which motor and air carriers cannot economically compete, and there are many shippers that are not located conveniently to water carriers. For these classes of shippers, competition within the railways sector is an important issue (Pittman, 1990; Kwoka and White, 2004).

A great deal of the policy debate regarding railways restructuring has concerned the possibility of the creation of competition among multiple train-operating companies over a monopoly track infrastructure. With this possibility has come the question of whether such competition would be more effective in the presence of complete "vertical separation" between train operations and infrastructure, or whether a less drastic "third party access" regime – under which the incumbent railway would remain vertically integrated but would be required to provide infrastructure access to independent train-operating companies under regulated terms and conditions – would be sufficient to support the introduction of competition, perhaps accompanied by some kind of "accounting separation" of the incumbent in the context of the creation of an overall holding company.

Although the UK's pioneering experience with complete vertical separation is generally considered a failed experiment, the competition directorate of the European Community continues to push member countries in that direction.[8] Especially in freight operations but also to a degree in passenger operations, both vertical separation and third party access regimes have more recently enjoyed some success in gradually creating competition among train-operating companies, to the benefit of both freight shippers and passengers in a number of countries (Gómez-Ibáñez and de Rus, 2006).

[8] See, e.g., Monti (2002); Knieps (2014); and Montero (2014).

As an alternative, minority voices in the debate have called for the creation of competition among multiple vertically integrated railway enterprises – a strategy sometimes termed "horizontal separation" to contrast it with "vertical separation" (Pittman, 2007a). Under such a regime, each railway enterprise runs trains on only the infrastructure that it controls, but shippers hope to enjoy either "parallel competition" or "geographic competition" among the independent vertically integrated railways.

Under "parallel competition", competing railway lines serving the same origin-destination pairs, as is common in the United States and Canada. In the United States, for example, both the Burlington Northern Santa Fe (BNSF) and the Union Pacific (UP) are vertically integrated railways that carry containers from the port of Los Angeles/Long Beach to Chicago, and both the CSX and the Norfolk Southern (NS) are vertically integrated railways that carry those containers from Chicago to Atlanta. The Canadian National (CN) and the Canadian Pacific (CP) railways are vertically integrated firms that similarly compete to carry freight between a variety of origin-destination pairs in Canada.

"Geographic competition", a more generalized form of what is often termed "source competition", relies on competing railway lines radiating out from common points, as in Mexico and Argentina (or Chicago or St. Louis). Under a regime focusing on geographic competition, shippers of commodity X at origin O may have only one railroad option for carrying their traffic to destination D_1, but they may still benefit from competition of other railroads serving the origin and offering to carry X to alternative destinations D_2 and D_3. Similarly, purchasers of commodity X at destination D may have only one railroad option for carrying their traffic from origin O_1, but they may still benefit from competition of other railroads serving the destination and offering to carry X from alternative origins O_2 and O_3.

James MacDonald's seminal empirical work (1987, 1989) showed the extent to which farmers in the Midwestern region of the US benefited from geographic competition, with different railways competing to haul their grain, even if those railways were carrying the grain to different destinations – often different seaports for export. 19th century Russian observers had noted the same benefits to farmers in the Russian empire when multiple privately owned, vertically integrated railway companies competed to carry their grain from the fertile Black Earth region to export markets – some going north to the Baltic Sea, others south to the Black Sea (Pittman, 2007b). The point generalizes to other commodities: in many situations, shippers of a commodity over an origin-destination pair that is served by a monopoly railway are protected from monopoly pricing by their ability to ship via other railways serving this origin to different destinations. Exactly correspondingly, in many situations, receivers of a commodity shipped over an origin-destination pair that is served by a monopoly railway are protected from monopoly pricing by their ability to "source" the product from other railways serving this destination from different origins.

The Mexican government relied explicitly on geographic competition when it restructured its freight railway in the 1990's, creating three privately controlled, vertically integrated firms with long-term franchise control over their infrastructure. These firms competed mostly to carry freight to and

from Mexico City, with the tracks in Mexico City jointly owned by the three major freight railways and the city government, and all shippers there were able to ship on all three railways.[9]

The Russian government included an explicit reference to the possible creation of competition among vertically integrated freight railways serving common origin-destination corridors (parallel competition) and competing for traffic to and from common points (geographic competition) in its original 10-year plan for restructuring the monopoly, government-owned Russian Railways Company (RZhD), a plan approved by the Cabinet in 2001 and the Duma in 2003 (Pittman, 2013). Though the reforms to date have not been in this direction, in 2013 a high level, government-supported think tank, the Institute of Natural Monopolies Research, hosted a conference and published a detailed study of reform options that included as one option – not the preferred one – "the feasibility to divide the single business entity (Russian Railways JSC) into several vertically integrated companies (VICs) competing among themselves" (IPEM, 2013). The specific restructuring plan analyzed would have had all three VICs serving the crucial coal-producing region, the Kuzbass – presumably in some sort of jointly owned "switching district" like the jointly owned Mexico City track – and then radiating out from there to the northwest, the southwest, and the east. Pittman (2013a) has argued that, with the current and planned expansion of the Baikal-Amur Mainline (BAM) in the east, this IPEM scenario that focused on geographic competition could be supplemented by the further division of the eastern railway thus created into two parallel competing components, the newer BAM versus the older Trans-Siberian.

One notably successful aspect of the implementation of the horizontal separation model in the Americas has been the attraction of private investment into these rail systems, initially in the form of bids for multi-decade exclusive franchise rights, and subsequently in the form of investments in to the infrastructure, locomotives, and rolling stock of the newly created vertically integrated railways. In both Brazil and Mexico, for example, the governments required the controlling rights of each franchise to be held by domestic investors, but encouraged the participation of international investors in the franchises. Table 1 shows the winning bids for the franchise rights that resulted from the franchising in the two countries and the lengths of the principal railways. Pittman (2017) calculates that the ten franchised freight railways average just over 4000 track-km in length, and that the average winning bid was US$95,700 per track-km, in late 1990's US$ -- equivalent to about US$140,000 in 2017 US$.

	Date of Concession	Length (track-km)	Winning bid (US$ million, at contemporaneous exchange rates)
Mexico			
Northeast	1997	4296	$1400
Southeast	1998	1484	$322
Pacific-Northwest	1998	8454	$527
Brazil			
Oeste	1996	1621	$61.2
Centro-Leste	1996	7080	$310.7
Sudeste	1996	1674	$871.5

[9] Unfortunately the government later hobbled its own creation by permitting the merger of two of the three railways, over the objections of the competition authority (Perkins, 2016).

Tereza Cristina	1997	164	$16.5
Sul	1997	6586	$193.4
Nordeste	1998	4534	$13.1
Paulista	1999	4236	$123.7
Totals		40,129	$3839
Average		4013	$384
Average omitting Tereza Cristina		4441	$425
Average US$/km	$95,700		
Average US$/km, omitting Tereza Cristina	$95,600		

Table 1. Values of winning bids for Brazilian and Mexican rail concessions. Source: Campos (2001); Villa and Sacristán-Roy (2013); calculations in Pittman (2017).

Furthermore, in the fifteen years following the restructuring in Mexico, private investments into the system totaled over US$6 billion – more than double the amount required and pledged by the consortia that won the concessions (Villa and Sacristán-Roy, 2013).

As the railways reform debate has progressed and different options have been pursued in different countries, there come to be greater appreciation of the possibility that different reform strategies might be appropriate in different countries and environments. There has in many cases also come to be a differentiation in the strategic options pursued for freight and passenger operations.

The UK is a good example. As mentioned, that country has been one of the pioneers in the creation of competition in railways. Originally the focus was on complete vertical separation and the creation of competition among multiple independent train-operating companies in both the freight and passenger areas (Foster, 1994). However, eventually it came to be widely believed that in an era of both widespread automobile ownership and discount airlines, passenger rail was dependent on government subsidies simply to survive. In that case on-track passenger rail competition was not sustainable, and the focus of policy moved to the creation of competition for monopoly franchises to control particular regional passenger rail operations in the tradition of Chadwick (1859) and Demsetz (1968).[10]

On the other hand, on the freight side the introduction of on-track competition has led to at least some competition between the old English, Welsh, and Scottish Railway (EWS, now a subsidiary of the German rail freight company DB Schenker) and Freightliner (Nash, et al., 2013). More generally, around the world, freight-dominant railway systems pay their own way without large-scale government subsidies – though there are sometimes government-required cross-subsidies across different classes of freight – and in fact generally earn profits, pay taxes, and often cross-subsidize passenger operations.

Empirical efforts to evaluate systematically the outcomes of the recent spate of railways reforms around the world, and especially to isolate the relative performance of different reform models, have been hampered by problems of data availability and quality, the short time period involved since reforms have been implemented, differences among railways sectors in different countries, and the possible endogeneity of reforms – both the reform decision itself and the reform path chosen. The best

[10] See, for example, Preston (2001, 2009).

and most recent studies suggest that most reform efforts have led to improved efficiency, though in addition to possible endogeneity one possible explanation here is simply that increased attention to industry structure and efficiency by itself leads to improvements (as arguably occurred in India – see Kumar and Mehrotra, 2009). Among the more specific findings:

- Where competition has been created among multiple train-operating companies – so-called "above-the-rail" competition – for traditional *passenger* operations, the European experience suggests that generally fares have been reduced and services have improved, but costs have increased, presumably reflecting the sacrifice of firm-level economies of density of operations (Nash, 2011; Preston and Robins, 2013). More recently, and somewhat unexpectedly, there has been in several countries competitive entry by "above-the-rail" high speed trains, and while the experience is too early for a full evaluation, indications are that passengers continue to benefit (Croccolo and Violi, 2013; Desmaris, 2016; Tomeš, et al., 2016; Tomeš and Jandová, 2017; see also Pittman and Choi, 2014).
- Where competition has been created above-the-rail for *freight*, the European experience has been even more successful, with incumbents in several countries rapidly losing market share to more nimble entrants (Pittman, et al., 2007; Deville and Verduyn, 2012; van de Velde, *et al.*, 2012; Knieps, 2013). On the other hand, because there are economies of scale associated even with the operation of non-integrated freight TOC's, the number of these available to any one shipper has generally been small, not quite the paradise of contestability that its original adherents may have hoped for.
- In general, reforms that have allowed additional TOC's to use the infrastructure have been found to increase operational efficiency as measured by data envelope analysis and stochastic production frontiers (Sánchez, et al., 2008, 2012; Couto and Graham, 2009; Friebel, *et al.*, 2010). However, it is not at all certain that complete vertical separation is more conducive to the introduction of competition or to increased efficiency than is a third party access model, perhaps structured around accounting separation of the incumbent (van de Velde, *et al.*, 2012; Mizutani and Uranishi, 2013; Nash, *et al.*, 2014; Mizutani, *et al.*, 2015).
- Furthermore, the introduction of competition among TOC's does nothing by itself to attract private investment into the infrastructure, often a high priority goal of restructuring in the first place (as we noted above regarding China). The effect of either vertical separation or third party access on infrastructure financing depends crucially on the broad strategy and fine details of the regime of access pricing (and other terms) that is set up, and there is a complete lack of consensus as to the optimal regime to be chosen (BTRE, 2003; Pittman, 2004a; ECMT, 2005; see also the more general discussions in Laffont and Tirole, 2000, and Decker, 2015).
- As noted above, the alternative strategy of horizontal separation of freight railways – the creation of multiple competing vertically integrated freight railways – has in several cases succeeded in attracting a great deal of private investment into previously moribund state operated railways and attracted significant levels of traffic from road back to rail, to the benefit of shippers, the broader economy, and the environment (Campos, 2001; Estache, et al., 2001; Kogan, 2006; Thompson, 2009; Villa and Sacristán, 2013).
- The vertical separation and third-party access models have mostly been applied in small-to-medium sized countries in Europe where passenger operations dominate the railways business. The horizontal separation model has mostly been applied in larger countries in the Americas where freight operations dominate the railways business – though some smaller Latin American countries have followed this strategy as well, including Colombia, Peru, and Uruguay (Kogan, 2006).

Any discussion of the restructuring of existing railway enterprises raises the issue of the structure of railway costs. This is an issue that has been much examined in the empirical literature, though there are inevitably differences in results based on samples, assumptions, and techniques. We may summarize the discussion regarding three important aspects of railway cost functions as follows:

- It seems by now well established that there are *economies of vertical integration* in railways, and thus that complete vertical separation increases transactions costs and operating costs -- though the magnitude of increase is very much in dispute. Vertical separation seems to increase costs more than otherwise a) in rail systems that are very densely operated, and b) in rail systems with a high proportion of freight traffic vis-à-vis passenger traffic (Mizutani and Uranishi, 2013; Nash, et al., 2014; Mizutani, et al., 2015). The former likely reflects straightforward advantages of intrafirm rather than interfirm coordination of operations, while the latter likely reflects the greater track wear caused by heavy freight trains, and the difficulty of getting the interfirm incentives set just right to address that problem (Pittman, 2005).
- *Economies of scale, as measured by system size*, seem to be exhausted at relatively moderate scales of operation. Savignat and Nash (1999) report a consensus in the literature that only relatively small railways operate at a level of unexhausted economies of system size, and Wilson (1997) finds that at the mean of his sample, US class I railways are operating with slight diseconomies of system size. The results of Preston (1994) and Bitzan (1999) suggest a flattening of the cost curve for system size at between (respectively) 2500 and 5000 miles, while Chapin and Schmidt (1999) also find a flattening of the cost curve, but at a higher mileage level, about 10,000 miles. More recently, Christensen Associates (2010) conclude that all the major U.S. railways are operating in a range of constant returns to scale, and have been for many years. Note that the average size of the concessions granted in Brazil and Mexico was in the 4000-4500 track-km range (Table 1).
- It appears, on the other hand, that *economies of scale as measured by density of operations* persist in more railway settings. Econometric studies have generally found that most existing freight railways are operating at levels where economies of density are not yet exhausted; this is the conclusion of a review of the literature by Savignat and Nash (1999) and of studies of US class I railways by Wilson (1997), Ivaldi and McCullough (2001), and Bitzan (2003). Only recently has Christensen Associates (2010) concluded that the major U.S. railways have likely exhausted all available economies of density. Note, however, that the Chinese railway by far the most densely operated major railway in the world.

3. The Chinese reform experience to date

The Chinese government has sped up the expansion of the railways network in recent years. From 2011 to 2015, China's 12th Five-Year Plan has been implemented. During this period, fixed-asset investment in the railway sector amounted to 3.58 trillion yuan, up 47.3 percent from the 11th Five-Year-Plan period. This investment in rail network expansion has resulted in 30,500 km of railways put into operation in the 2011-2015 period, more than doubling that of the previous five years. The extensive railway network carried 15.5 billion tons of goods and 10.6 billion passengers during the 12th Five-Year Plan period, up 13.6 percent and 49.1 percent, respectively, from the 11th Five-Year Plan period.

Along with the implementation of the "One Belt, One Road" Initiative, China has expanded its rail network via connections with other railways across the Eurasian landmass. Constructing intercontinental

railway transport connections between China and Europe is one of the most crucial elements of the initiative. In addition, from 2011 to 2015, regular service along new railway routings that directly connect China to Europe started operations. In particular, the Sumanou Railway is the first direct railway connection with regularly scheduled service with Europe in Southeastern China. The Yuxinou Railway, from Chongqing to Duisburg, Germany, operated by Trans Eurasia Logistics, has significantly lowered the transportation expense to 0.6 USD for one carriage per kilometer by 2013. Until the end of 2015, the Yuxinou Railway operated 453 times with 220 of these exchanges taking place in 2015 alone. These regular intercontinental railway routings offer a competitive and faster alternative to the transport of goods via sea routes between China and Europe (Li, *et al.*, 2016).

For a long time, railway construction investments in China have been financed by the Railway Construction Fund and bank loans. Currently, the China Railway Corporation is the major investor for railway construction, accounting for over 90% of total investments. However, due both to other demands on central government funds and concerns about the growing level of railways-related debt, the Chinese government has begun seeking other sources of investment, including local and regional governments, domestic and foreign investors. Joint-venture railway enterprises in China were born and grew up in the 1980s. The number of joint-venture railway enterprises keeps increasing. The China Railway Corporation is responsible for about 60% of the investments in most joint-venture railway construction, while local governments and state-owned enterprises are responsible for the rest. Through 2013, there were 187 railway transport enterprises, including the China Railway Corporation itself (made up of 18 regional railway administrations), 109 joint-venture railway enterprises (with China Railway Corporation as the major shareholder) that are managed by local railway administrations, 21 joint-venture railway enterprises (with China Railway Corporation not the major shareholder), and 56 local railway transport enterprises.[11]

A series of gradual reforms have been applied at the Ministry of Railways (MOR), and some changes have been made in MOR's organization and management (Luger, 2008). Around the year 2000, the MOR proposed a vertical separation plan, the separation of the national rail infrastructure network from the passenger and freight train operations (Yin-nor, 2016). However, early steps led to big losses in the passenger transport sector, in particular, an annual loss of 70 million yuan in Zheng Zhou Railway Administration. As a result, MOR was forced to abandon its vertical separation reform regime in 2002. In March 2013, China implemented a new reform on the MOR by separating enterprise functions from government functions, setting up the China Railways Corporation and the National Railway Administration. China Railways Corporation is a state-owned company reporting directly to the central government, to be financed by the Ministry of Finance and regulated by the Ministry of Communications (MOC) and the National Railway Administration. China Railways Corporation is responsible for the former enterprise functions of the MOR, including passenger and freight transportation, operating and managing China's rail network and railway construction, and day-to-day railway safety. The National Railway Administration is responsible for the former administrative functions of the MOR, including formulating railway technical standards, overseeing railway safety and service quality, and ensuring that railway projects are implemented according to the required standards.[12]

[11] Sun and Zhang (2009); Wang and Tan (2016); Wei (2016). See also Wu and Nash (2000) for a discussion of the early experience with rail joint ventures in China.
[12] Wei (2016); Xu (2016).

As has been the case in other countries such as the Russian Federation, the separation of government functions from corporate functions marks a significant step in the progress of Chinese railway reform. However, railway transport in China is still broadly monopolized. Strictly speaking, the current eighteen Railway Administrations are not enterprises, because the China Railway Corporation is responsible for the unified dispatch and control of the eighteen Railway Administrations. A particular Railway Administration controls transportation only when the origin and destination are both within that Railway Administration. Otherwise, transportation operations are to be turned over to China Railway Corporation and placed in a unified account. The China Railway Corporation then provides subsidies to those companies with relatively low freight volume. Thus, the Chinese railway system is still a vertically integrated monopoly with centrally imposed cross-subsidization (like the Russian, Ukrainian, and Indian railways, for example). Further reforms will be required if competition is to be created (in any form) and private investment funds attracted.

China is currently seeking a restructuring plan that would both make the transport enterprises responsive to market demands and allow the transport enterprises to manage as commercial entities with commercial goals.

Rail freight in China has grown rapidly in recent years; however, the role of container services remains small and underdeveloped. In order to shift container transport to railways from other modes, especially from road transport, the China Railway Corporation has upgraded its container infrastructure and equipment. In addition, the China Railway Corporation has also stated its intention to expand its container transportation services in the central and western regions, in order to support western development in China (Pittman, 2011; ADB, 2013).

4. The Chinese scholarly debate on reform models

As in rail reform discussions in other countries, Chinese researchers and policy analysts have debated the options of vertical separation and horizontal separation. As discussed above, vertical separation is an arrangement that separates the infrastructure sector from the operating sector, usually adopted in European countries; it may be partial (organizational separation) or complete (ownership separation). Horizontal separation is an arrangement with separate vertically integrated companies maintaining control of both railroad track and the trains running over the track. The key advantage of vertical separation is the potential for the introduction of competition among different train operating companies over a single set of track. The key advantage of horizontal separation is the maintenance of economies of scope in infrastructure and operations.

Li (2010), Yu and He (2016), and Xu (2016) argue that vertical separation is a suitable model for the Chinese railway sector, because vertical separation makes the introduction of direct competition within the rail operating sector possible in a relatively quick and straightforward manner. In addition to the introduction of competition within the rail sector, Li (2010) emphasizes the fact that vertical separation maintains economies of scale in the network sector.

On the other hand, the scholarly debate emphasizes two important disadvantages of vertical separation in the Chinese rail system, namely the need for regulation of the use of the separated rail

infrastructure and potentially high transactions costs (Yu and He, 2016). For the first issue, Besanko and Cui (2016) argue that the third-party access version of the vertical separation system – under which the infrastructure operator continues to operate trains – requires a strong regulator, which has not yet been developed in China, to ensure non-discriminatory access. As noted above, the setting of access charges for rail infrastructure is a complex issue without consensus as to the most appropriate path under either third-party access or full vertical separation. The problem of discrimination in access terms was of course the rationale behind the first great modern vertical separation case, that of *U.S. v. AT&T* (Brennan, 1987), and discrimination concerns are not likely a factor if complete vertical separation is the reform path chosen.

For the second issue, Zhao, *et al.* (2005, 2012) point out that railway reorganization provides a valuable real world example of Coase's concept of transaction cost, which is principally the cost "of discovering what is the relevant prices are" (Coase,1937). Williamson (1985) argued that this definition is not operational, "unless the factors responsible for transaction cost differences be identified". In fact, the factors identified by Williamson -- asset specificity, opportunism, and frequency of transactions – are specifics of Coase's general concept. Zhao, *et al.* (2005, 2012) argue that restructuring the railway is fundamentally a question of how to delineate the boundary of a firm, and that the basic principle of railway reorganization should be setting the boundary at the interface with lowest transaction cost. Vertical separation of railways virtually always sets the boundary on the interface between rail and wheel – arguably the point with the *highest* transaction costs because of information asymmetry and different interests of the different firms (Pittman, 2005). If the separated network firm and operating firms cannot discover the relevant prices -- the appropriate access charge, charges structure, and other terms -- regulation and hence competition may not work well, because regulators, especially new and/or weak regulators, will have even more trouble calculating appropriate terms. So an important advantage of maintaining vertical integration in this context is that it removes the necessity of "discovering" the appropriate price.

Tang and Zhao (2015) further introduce a principal-agent model comprising organization structure to show the different orientation of interests of the network firm and the operating firms. Under vertical separation, the network company may lack the appropriate financial incentives to maintain an appropriate level of investment in the infrastructure. This would then put operating companies at risk. The separation of the finances and incentives of the network company and operating companies, which are determined by the organizational structure, could result in safety problems under the vertical separation model, similar to the UK experience. That is arguably why after 17 years of the vertical separation of SNCF and RFF of France, the two were re- integrated into a unified enterprise in 2015. Horizontal separation, with a unified management focused on the requirements for appropriate maintenance of the point "where steel meets steel", would alleviate the problem (Tang and Zhao, 2015; Cui and Besanko, 2016).

Zuo (2016) and Zuo, *et al.* (2016a) argue that the vertical separation model offers a superior path for addressing the debt problem of the Chinese railways, but why this should be so is unclear. It seems more likely that either broad reform strategy will involve the painful policy decision to write off a large portion of these accumulated debts.[13] Correspondingly, several authors – including Zhao (2005), Rong and Bouf (2005), Tang and Zhao (2016), and Zhao, *et al.* (2016) – emphasize the currently high level of uncertainty in transactions between the rail infrastructure and operating firms, due to the fact that the

[13] See, for example, Yang Song and Vincent Chan, "China Railway Operators Sector: Silver train is coming, get on now," Credit Suisse, Asia Pacific Equity Research, 18 June 2013.

Chinese railway system is in an uncertain transition period, but this factor also seems likely to complicate either reform strategy equally. Finally, Besanko and Cui (2016) argue that economies of network size may not be especially relevant to this debate, because the economies of network size may be already exhausted in the Chinese rail system (as in other large modern railways, as we noted above).

Indeed, the possibility of introducing competition within the rail sector is not exclusive to the vertical separation model. Pittman (2004b) has presented one possible reform model for the Chinese rail system, which maintains vertical integration with the introduction of competition at important origin and destination points. The railway enterprises can be reorganized and restructured so that each of these cities is expected to be served by multiple, independent, vertically integrated rail enterprises, which leads to geographic competition between these rail enterprises at important origin and destination points. Further, Pittman (2011) has estimated that the horizontal restructuring plan would create at least parallel and source competition for about half of Chinese rail freight tonnage. In addition, as Sun and Zhang (2009) note, intermodal competition may offset the insufficiency of competition within the rail sector.

Some researchers have proposed other, "hybrid" options for Chinese railway reorganization. Wu and Nash (2000) argue that vertical separation in China would be difficult due to the very high level of density of operations on the system, but a basic sectoral organization, combined with regionalization of short-distance passenger services, franchising of non-core activities, and a greater degree of open access may be a good combination. Wang (2014) proposes vertical separation of passenger operations while maintaining the integration of freight operations and the network in China for several reasons. First, separation of passenger transport sector and freight transport sector is beneficial for efficient and specialized operation in both sectors. Second, relatively fixed lines, locomotives, and timetable results in low transaction costs between passenger transport companies and the network company, compared to higher transactions costs between freight transport companies and the network company. Third, in contrast to Western Europe, where the vertical separation model has seen the most success, in China freight transportation accounts for a greater proportion of rail market than passenger transportation – increasingly so as high speed rail moves passengers off the standard rail infrastructure. Thus the integration of freight sector and railway network may reduce high coordination costs between freight companies and the network company as well as maintaining incentives for investment in infrastructure, while the separation of the passenger sector could enable competition there.

5. Restructuring proposal #1: Three regional railways

Based on the analysis above, we believe that the horizontal separation model is a more attractive choice than the vertical separation model as the basis for a restructuring strategy for the Chinese freight railway system. We believe that Chinese freight railway restructuring should focus on breaking up the monopoly, introducing competition, improving transport efficiency, promoting railway development, and attracting private investment.

As discussed above, a number of large and medium-sized countries have relied upon competition among independent, privately controlled, vertically integrated companies to protect freight rail shippers from monopolistic abuses by their railway service providers. The most conspicuously successful examples include Canada, Mexico, and the United States, but Argentina, Brazil, Chile,

Colombia, Peru, and Uruguay have also relied to some degree on this form of competition in their railway restructuring regimes, and there has been serious consideration and analysis given to the adoption of this reform strategy in the Russian Federation as well.

One strength of the horizontal separation model lies in the preservation of the vertical economies of a single enterprise controlling investments and day-to-day activities in both infrastructure and train operations. A second strength, well demonstrated in the North American and Latin American experiences and discussed earlier, has been its year-in, year-out success in attracting huge amounts of private investment into the infrastructure.

The principal weakness of the horizontal separation model vis-à-vis the vertical separation and third party access models is that horizontal separation inevitably leaves some shippers "captive" to only one railway. There are different ways to address this problem. In the US, there is a regulatory regime that places a ceiling on the rates that may be charged by the serving railway to "captive shippers" (Pittman, 2010a, 2010b). In addition, as a remedy to protect shippers potentially rendered captive by a rail merger, the US regulator has sometimes required the merged railway to provide "trackage rights" to an alternative railway that can then run its trains over the merged railways tracks to provide competitive service – a limited regulatory imposition of a third party access regime (Gallamore and Meyer, 2014). In Canada, captive shippers located with a short distance of a second railway may demand that the serving railway "switch" the traffic to the second railway, under regulated terms and conditions (Clemens, 2011; Cairns, 2014; TRB, 2015; Arsenault and Nolan, 2018). Of course many shippers can use other modes of transport besides rail, so "intermodal competition" via motor carriers or water carriers may protect some shippers. But there is no discounting the fact that the vertical separation option has an advantage over the horizontal separation option in this regard, since as a matter of course it provides for at least potential access by more than one train-operating company to all shippers on the public infrastructure.

In this section and the next, we discuss two detailed proposals for restructuring the Chinese freight railway system according to the broad strategy of horizontal separation. We begin with the three-regional-railways proposal for the next step of Chinese freight railway restructuring previously introduced by Zhao, *et al.* (2012) and Zhao (2013).

Currently, there are 18 Railway Bureaus within the China Railway Corporation (CR). This proposal begins with dividing up the current railway system into three vertically integrated regional railway companies, including a Northern railway company, Central railway company, and Southern railway company. The Northern railway company includes the Beijing railroad bureau, Taiyuan railroad bureau, Shenyang railroad bureau, Harbin railroad bureau, Hohhot railroad bureau, and former Jinan and Qingdao railroad sub bureau that belong to the Jinan railroad bureau. The Central railway company includes the Shanghai railroad bureau, Zhengzhou railroad bureau, Xi'an railroad bureau, Wuhan railroad bureau, Lanzhou railroad bureau, Urumqi railroad bureau, Qinghai Tibet railway company, and former Xuzhou railroad sub bureau that belongs to the Jinan railroad bureau. The Southern railway company includes the Guangzhou Railway (Group) Corporation, Chengdu railroad bureau, Nanchang railroad bureau, Kunming railroad bureau, and Nanning railroad bureau. Map *2*2 shows the three regional railway companies.

Map 2 Three-Regional-Railways Proposal

After setting up the three regional railway companies, we propose to restructure the railroad bureau, due to the problem of too many transaction interfaces. Sub companies are organized based on the major artery lines, and each sub company takes responsibility of one related artery lines and other branches close to the artery line. Taking the Central railway corporation as an example, we need to organize: in the south-to-north direction at least seven sub companies managing coastal corridor, Jinghu corridor, Jingjiu corridor, Jingguang corridor, Dazhan corridor, Baoliu corridor, and Lankun corridor, respectively; in the east-to-west direction at least four sub companies managing Luqiao corridor, Ningxi corridor, Along the Yangtze River corridor, and Hukun corridor. Thus, each regional railway company will organize about 15 sub companies, which divides the artery line, which is over 2000 km, to at most three parts, managed by regional sub railway companies. Then, two-level competition is introduced to Chinese railway system: on the one hand, the three regional railway companies may compete with each other; on the other hand, adjacent major artery lines within each regional railway company may compete (in a more limited way) with each other.

The three-regional-railway proposal has a number of advantages. First, the three proposed regional railways cover the Yangtze River Delta, Pearl River Delta, and Bohai Rim economic zones respectively. Second, the area, population, and GDP within the three regional railways are of roughly equal magnitudes, which should lead to the three railways being approximately equally financially stable and attractive to private investors. Third, the three regional railways can cooperate with the current Northern, Central, and Southern international shipping centers respectively. Fourth, profitable and unprofitable railroad bureaus are evenly distributed within the three regional railway companies, which allows each regional railway company to take full responsibility for its own profits and losses, without subsidies from the government or cross-subsidies from other parts of the system. Fifth, in addition to maintaining the economies of vertical integration, the three regional railway companies are clearly large

enough to exhaust the available economies of system size as estimated by the various econometric studies cited above.

More broadly, the three-regional-railways proposal is beneficial to improving transport efficiency. Transactions between adjacent regional railway companies are reduced dramatically: transaction interfaces can be reduced from 67 among 18 railroad bureaus to 22 among three-regional-railways. According to freight statistics of each railroad bureau and the transaction interfaces in 2005, the exchange traffic with other companies would account for 20%, 40%, and 25% of traffic within the Northern company, Central company, and Southern company, respectively. Thus, the major cargo flows can be included within each regional railway company.

Under the three-regional-railways model, adjacent sub-companies, which are in the same artery line, have common interests, because one sub-company attracting loaded wagon flow in the artery line will also increase loaded wagon flows of the adjacent sub-company in the same artery line. This will decrease transaction costs between adjacent regional companies. In each artery line, adjacent sub-companies may cooperate with each other, while in each regional company, sub-railway companies in adjacent artery lines may compete with each other.

Perhaps even more important, the three-regional-railways proposal should be good for attracting private investments in Chinese railway system, including 1) private investments to the construction of some coal shipping corridors, with large traffic volume of dedicated coal shipping lines guaranteeing profitability and scarcely any exchange traffic with other lines; 2) private investments to branch railways; and 3) private investments to setting up freight rolling stock rental companies. Further supporting the development of railways in China, the regional railway companies would take full responsibility for the construction of the railways, including financing, designing, investing, constructing, operating, and repaying. The integration of construction and operation as well as the integration of financing and repaying will improve the efficiency of construction and operation, which is good to railway development in China. And, as noted above, because the three companies would have broadly similar revenue and cost profiles, they should be equally attractive to private investors.

A disadvantage of the three-regional-railways proposal as compared with the alternative horizontal-separation plan discussed below is that it is not based on the creation of intramodal competition for shippers and as a result does not protect shippers from the market power of railways by creating either parallel competition or geographic competition to any significant degree. To be sure, many actual and potential rail shippers are protected by intermodal competition in this regard: shippers of high valued commodities can and do use motor carriers to transport their products, and shippers with locations convenient to rivers, seas, or oceans can and do use water carriers to transport their products. However, some shippers – producing or purchasing bulk commodities and situated at inland locations – have neither option, and would be, in US regulatory parlance, “captive shippers” vis-à-vis their rail carrier under this scenario. A restructuring plan like this one would then require some kind of tariff regulation to prevent monopoly abuses. An advantage of the three-regional-railways proposal in this regard is that three railway companies with broadly similar revenue and cost profiles may lend themselves well to some form of yardstick regulatory regime (Decker, 2015).

6. Restructuring Proposal #2: Vertically integrated railways competing over parallel routes and to and from common points

In this section of the paper, we outline a broad proposal for the reorganization of the Chinese railways system based on a group of privately controlled, vertically integrated freight railways that relies on both parallel and geographic competition to protect shippers from monopolistic abuses, broadly similar to those presented in Pittman (2004b; 2011). We begin by listing several criteria that a well designed plan might be expected to satisfy, before proceeding to one specific possibility.

First, note that the Chinese railway system is the second largest in the world, currently at about 121K km (75K miles), and growing. About 19K km (12K miles) of this constitute the separate, high speed rail network, leaving about 102K km (63K miles) for freight and traditional passenger trains.

Table 6.1 shows the length of the seven North American Class I railways.

Railway	Length in km (K)	Length in miles (K)
BNSF	52.3	32.5
UP	51.7	32.1
NS	46.7	29
CSX	34	21
CN	32.8	20.4
CP	20	12.5
KCS (including KCS Mexico)	9	6

Table 6.1 Length of North American Class I Railways

In Mexico, the merged Ferromex/Ferrosur is about 12K km (7.5K miles) in length, while the original TFM, which operated as a joint venture with KCS for ten years before KCS bought the remaining shares of its co-owner, was about 3.6K km (2.3K miles) in length.

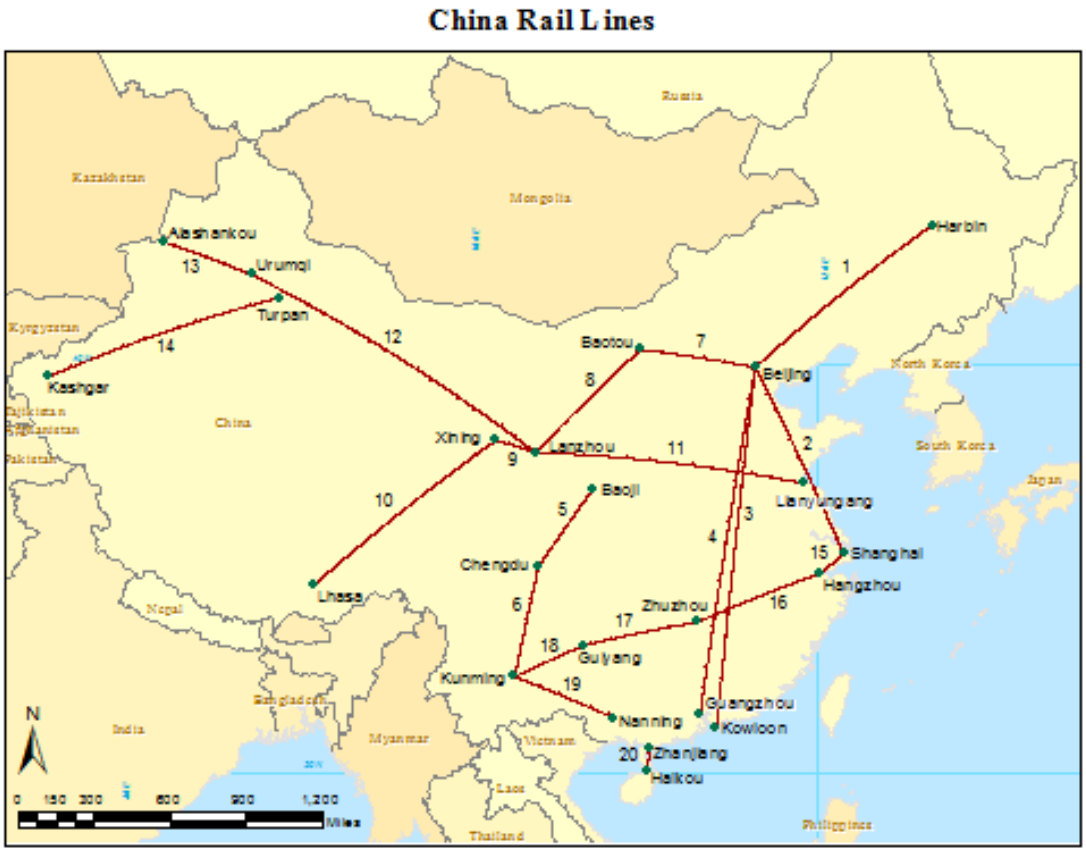
As noted above, econometric evidence suggests that the six largest class I's, at least, are likely operating at a scale where they have exhausted available economies of system size. Thus, as we observe the growing size of the Chinese railway system – noting especially the significant additional trackage planned for the new Northwestern-Southwestern corridor – a plan to divide the system into two or three more-or-less equal-sized railways would create systems in the range of the largest to the fourth largest of the North American class I's, while a plan to divide the system into five or six more-or-less equal-sized railways would create systems in the range of the smaller of the two Canadian class I's and still well larger than the smallest US class I (the combined three-country KCS) or the merged larger Mexican railway (Ferromex/Ferrosur).

Second, note three features of the Chinese railways that are important to keep in mind in a restructuring plan.

First, as alluded to in the previous section, the current system features six "Artery Lines": Beijing-Shanghai (Jinghu), Beijing-Guangzhou (Jingguang), Beijing-Harbin (Jingha), Beijing-Hong Kong (Jingjiu), Lianyungang-Lanzhou (Longhai), and Zhejiang-Jiangxi (part of Shanghai-Kunming, or Hokun) (Wu, *et al.*, 2014). These six all operate at close to capacity – though there are hopes that increased use of high speed lines will free up some capacity for more freight operations – and include some of the most densely operated freight rail segments in the world. Note that the first four of these are basically north-south railways, while the last two are basically east-west. Note also that the Beijing-Guangzhou and Beijing-Hong Kong lines run basically parallel for their entire distances.

These six Artery Lines are represented on the schematic Map 3 of principal Chinese rail lines as follows:

- Beijing-Harbin, line 1
- Beijing-Shanghai, line 2
- Beijing-Hong Kong, line 3
- Beijing-Guangzhou, line 4
- Lianyunggang-Lanzhou, line 11
- Zhejiang-Jiangxi, line 16



Map 3

Second, as noted above, over half of the cargo carried by Chinese freight railways is coal, and this is both crucially important for the Chinese economy (especially regarding electricity generation) and likely only to grow in importance in the future. Coal production has been concentrated in the extensive coalfields of the provinces of Shanxi and Inner Mongolia and to a lesser degree in neighboring provinces; in addition, the far western Xinjiang province accounts for a small share of production but is projected to increase its share, especially with planned increases in western railway capacity that are part of broader plans to support the economic development of the far west. Because coal production is concentrated in the near northwest while electricity production and consumption are concentrated along the

economically burgeoning east coast, a great deal of near northwestern coal travels by rail either east to the Yellow Sea broadly and the Bohai Sea in particular (and then by sea to East China ports further south) or south to the Guangzhou region (World Bank, 2009; Rui, et al., 2010; Wang and Ducruet, 2014). Map 4 is a schematic map showing the most important rail lines carrying coal, some of them carrying coal exclusively.

Map 4

Third, there is growing interest and activity in the shipment of freight from the East Asia in general and China in particular to Europe via rail as an alternative to the much slower all-water route (Luica, 2017). Much of this interest and activity related to container traffic carrying electronics goods whose values are high enough that the extra time at sea imposes a significant cost on shippers and customers. At present there are three international gateways that account for the lion's share of freight rail traffic traveling from and to China:

- The Alataw Pass, northwest of Urumqi and bordering the large Khorgos Gateway project in Kazakhstan (and a crucial component of the Chinese government's "One Belt, One Road" initiative, also known as the New or Iron Silk Road);
- Erenhot, northwest of Beijing in Inner Mongolia, on the border of Mongolia and, after passing Ulaanbator and central Mongolia, connecting to the Trans-Siberian Railway at Ulan-Ude;

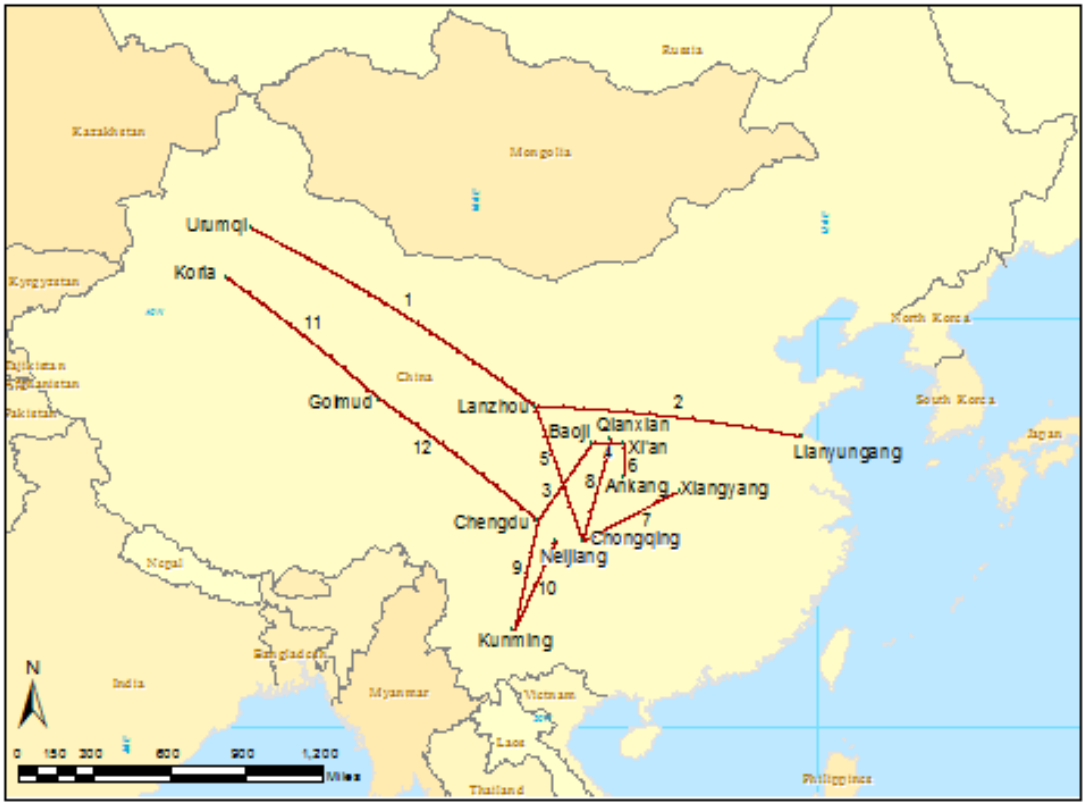
- Manzhouli, northwest of Harbin on the China-Russia border, connecting to the Trans-Siberian Railway at Chita.

Only the first of these offers even in principle a completely alternative routing to the second and third, since these latter two both involve long trips on the Trans-Siberian Railway and then other portions of the Russian Railways (RZhD); in fact the first usually connects with the Trans-Siberian at Yekaterinburg, but long term plans and hopes call for a southern route that would pass through Iran and Turkey and avoid Russia altogether (Pittman, 2013b; Smith, 2017). Still all three in principle offer independent intra-China alternatives to international shipments, so that – as in the original Mexican reform plans – all three could compete for import and export traffic for individual shippers and receivers.[14]

Finally, according to the Chinese government's "Medium and long term railway network planning (2016-2025)," dramatic new investments are projected to create a new Northwestern/Southwestern corridor, which will include several existing lines but will add lengthy Korla-Golmud and Golmud-Chengdu lines that will run basically parallel to the Lanzhou-Urumqi (Lanxin) line (line 12 in Map 5) in the sparsely populated far northwest. Map 6.3 provides a schematic look at the planned Northwestern/Southwestern corridor.

[14] Only one of the three appears on Map 3, at the end of line 13.

Planned Northwestern/Southwestern Corridor



Map 5

There are likely a large number of potential reform plans that could create a good deal of parallel and geographic competition among, say, six carefully outlined vertically integrated railways, and to choose among the most promising of these would clearly require a good deal more detailed study than we have performed. Nevertheless based on the above four features of the existing system, it seems that the outline of a new system might include the following steps.

First, as with the Russian proposal for the Kuzbass, the Mexican system of joint ownership of track serving Mexico City, and many jointly accessed "switching districts" in US cities and shipping points, carve out an area in Shanxi and Inner Mongolia where any railway line that serves the general area has access to all mines, supervised by a jointly administered dispatch company. This beginning – which of course has the flavor of the vertical separation strategy – will allow any coal mine operator to enjoy competition from multiple independent railway companies offering to carry the coal east to the water or south to customers overland.

Then divide up the remaining rail system into multiple, independent vertically integrated railway enterprises, something like as follows:

- Create independent Beijing-Guangzhou and Beijing-Hong Kong lines to provide competition for traffic going south from Beijing, and provide both with access to the Shanxi/Inner Mongolia coal switching district;
- Create geographic competition at Shanghai with independent Beijing-Shanghai and Shanghai-Kunming lines, and extend the Beijing-Shanghai line to Erenhot;
- Create broad parallel competition from the East China Sea to the far northwest by connecting the Lianyunggang-Lanzhou line with the Lanzhou-Xinjiang line and having that line compete with the Shanghai-Kunming line extended to Chengdu and thence to Korla, with possible trackage rights over the Lanzhou-Xinjiang line from Korla to the Alataw Pass, and by connecting either Guangzhou or Hong Kong with Kunming and then Kunming with Chengdu;
- Create a third, longer north-south line by joining the Beijing-Harbin line, with an extension to Manzhouli, with coal lines extending south from Beijing and then joining the Jiao Zuo-Liu Zhou (Jiao-Liu) coal line (line 7 in Map 6.2).

Under such a plan – which we emphasize deserves much more careful study – we observe the following:

- Beijing is served by five railways radiating out in different directions – not much different from Chicago;
- The important Shanxi/Inner Mongolia coal mines are served by three railways – the same that would serve the Kuzbass under the Russian reform plan discussed above, and one more than currently serve the massive coal production operations of the Powder River Basin in Wyoming;
- Three to four (depending on possible trackage rights in the far northwest) independent railways offer service from China to Europe, one eventually through Central Asia and two through Russia;
- Three railways offer service from South China Sea ports to the interior, with two going as far as Xinjiang – not much different from the four North American intercontinental routings offered by the CN, the CP, and combinations of the eastern duopolists (CSX and NS) and the western duopolists (BNSF and UP).

7. Conclusion

The continued success of Chinese economic growth will depend to no small extent on the ability of its railway system to continue expanding its capacity to carry both coal from mines to generation plants and manufactured products to export points and even international destinations. As alternative demands on central government resources continue to grow, the massive financial resources necessary for such railways expansion will have to come increasingly from the private sector. Of the two most debated and implemented strategies for restructuring government-owned railway monopolies, the horizontal separation model has proven most clearly successful in attracting the large private investments necessary to maintain and expand railways infrastructure.

In this paper we have presented two alternative restructuring plans based on the horizontal separation model. The first is based on the creation of three regional railways of similar size and strength designed to be attractive to investors and transparent to regulators; the second is based on the creation of more – perhaps six – railways designed to provide parallel and geographic competition for shippers. Both offer the advantage of maintaining economies of vertical integration between infrastructure and operations, and both avoid the disadvantages of the vertical separation model of the creation of incentives for discrimination and the necessity of creating an access charge regime. On the

other hand, both fail to achieve the goal of the vertical separation model of providing intramodal competition for all shippers, and thus both preserve the likely necessity of some regulatory regime for the benefit of captive shippers.

We hope that our presentation and discussion of the two proposals will contribute to the ongoing, crucially important debate regarding the best way forward for the Chinese railways.

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