Chinese Railway Reform and Competition: Vertical or Horizontal Restructuring?

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One of the key determinants of China's ability to continue its economic growth into the 21st century and to distribute the benefits of that growth to a broad spectrum of the population will be the further development of its railroad system. This paper examines the possibilities for improving the performance and increasing the capacity of China's railroad system through the introduction of competition. Countries throughout the world are in the process of abandoning the centralized, monopoly, state-owned model of the railway in favor of models that create competition. However, different competitive models have been proposed and are being tried out. This paper discusses the reform experience with the two basic models and their variations, focusing especially on some of the operational and regulatory challenges that vertical separation is now better understood to impose. It seeks to apply the lessons of the experience to date to the situation of China, where -- unlike in many countries, developing and developed -- one important criteria for choosing a reform model is its ability to provide the incentives for appropriate levels of new investment to be undertaken at the appropriate locations. The paper closes with the presentation of one possible reform model for the Chinese rail system, a model that maintains vertical integration while creating competition for shippers at many important origin and destination points.

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"No matter whether it be between the same kind or different kinds of conveyance, or between water and land routes, where there is keen competition, passenger tariffs and freight rates are usually much lower."
Mongton Chih Hsu, *Railway Problems in China*, New York: Columbia University (Studies in History, Economics and Public Law LXVI:2), 1915.

1. Introduction

[1] The author is Director of Economic Research and Director of International Technical Assistance in the Economic Analysis Group of the Antitrust Division. An earlier version of this paper was presented at the Seminar on Railway Reform, Restructuring and Competition, Beijing, January 2002, sponsored by the OECD and the Development Research Center of the State Council of the People's Republic of China. The author thanks the seminar participants for many helpful comments, and Julia Lynch and Marilyn Walker for excellent research assistance. The views expressed are those of the author, and do not necessarily reflect the views of the U.S. government or the U.S. Department of Justice.

One of the key determinants of China's ability to continue its economic growth into the 21st century and to distribute the benefits of that growth to a broad spectrum of the population will be the further development of its railroad system. The system currently carries over 70 percent of the intercity surface freight traffic in China and is operating close to or at capacity, and there are already indications that transport capacity is becoming a binding constraint on further growth.[2] Motor carriers have increased their share of traffic from under ten percent thirty years ago, but, as in other countries, motor carriers are most effective at shorter rather than longer hauls. The average length of a rail freight movement in China is over 800 km, beyond the distance for which motor carriers can typically haul many types of freight economically. And by any of the usual measures, China's road system is inadequate to take much more of the load. China ranks 73rd in the world in km of paved road per million population, at 815; by comparison, the US is 7th at 14,195, Russia is 27th, at 5087, and India is 66th, at 1076. In terms of density of territorial coverage by the road system, China's level of 0.16 km/km2 is similarly far below the US at 0.65, Russia at 0.30, and India at 0.73.[3] China's impending entry into the WTO is expected to increase its international trade (particularly imports) further, resulting in increasing strains on the domestic transport infrastructure.[4]

A special problem for China has been the uneven distribution of the benefits of rapid economic growth. As in other developing countries, China's growth has greatly exacerbated inequalities of income distribution, both between the rich and the poor and between urban and rural populations, even as it has improved the lot of the poor overall. One analyst argues that "in less than two decades, China has transformed itself from one of the most egalitarian countries in the world to one of the, arguably, most unequal ones."[5]

But China's worsening pattern of income inequality has a strong geographic component as well: the coastal areas are increasingly growing richer and becoming more integrated into the world economy, while the vast interior remains relatively poor, isolated, and rural. "The top ten provinces in terms of attracting foreign capital and technology are all located on China's coast."[6] One frequently hears that it is easier to engineer trades between (coastal) Shanghai and California than between Shanghai and inland cities such as Lanzhou or Urumqi, and this reflects the inadequacies of the road and rail transport systems. The political implications of this pattern of worsening regional

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[2] Thompson, *et al.* (1998); Thompson (2000). Perkins (2002) describes serious problems with coal transport. Park, *et al.* (2002) find that congestion on the railway network, especially in the south, has prevented equalization of grain prices in different areas and contributed to uneven market development.

[3] World Bank *Competitiveness Indicators*; *World Road Statistics 2000*.

[4] Toby Gooley, "China's new role in world trade," *Logistics Management & Distribution Report*, August 1, 2000.

[5] Zhang (2000), at 91.

[6] *Ibid.*

income inequality are a serious policy concern.[7] According to a recent report, "the increasing gap between rich and poor ... was the hottest topic at the past two annual meetings of China's legislature, and the bulk of Premier Zhu Rongji's work report to the current legislative session focused on increasing the incomes of China's poorest farmers."[8] A recent government program for developing the country's western provinces lists "developing infrastructure" as the number one priority.[9]

[7] See, *e.g.*, Kanbur and Zhang (1999); Hare and West (1999); and Zhang (2000), *ibid.*

[8] John Pomfret, "In China, the Rich Seek to Become the 'Big Rich'," *Washington Post*, March 17, 2002.

[9] Démurger, *et al.* (2002), citing State Council (2000). Démurger (2001) finds a strong effect from geographic patterns of investment in transport and telecommunications infrastructure on province-level differences in economic growth.

A variety of proposals have been made seeking to insure that railway capacity and capability are contributors to, rather than constraints on, both overall economic growth and the wider sharing of the benefits of that growth. The Ministry of Railways is in the process of expanding capacity by constructing new lines, improving existing lines with double tracking and electrification, increasing containerization capacity, and upgrading locomotives and rolling stock.[10] The construction of new lines between Huaihua and Chongqing and between Chengdu and Lhasa Tibet is partly aimed at addressing regional disparities in development.[11] It is important that these efforts continue, and that any structural systemic reforms do not act to discourage such basic capacity improvements.

Moreover, there are widespread proposals and discussions of ways to improve the incentives for efficient system operation, whatever the capacity. As in a variety of other countries around the world, these include proposals for separating the functions of system operator and system regulator that are now both performed by the Railways Ministry, separating the accounting of infrastructure and operations, increasing tariff flexibility to improve cost coverage and insure that efficient decisions are made regarding transport modes and business locations, and various ideas for restructuring ownership and/or operations to create competition among separate rail enterprises for the business of individual shippers.[12]

This paper will focus on the last issue, the possibility of creating intramodal competition for rail freight transportation. (Policies regarding rail passenger transportation raise a generally different set of questions, and in any case are relatively less important for the Chinese railway system than for that of, for example, India.) I will begin by discussing the different ways in which competition among railroads has been introduced and maintained in different countries. I will seek to integrate into the analysis the current state of the Chinese economy and Chinese economic reform, in order to consider which of these different ways, or which combinations of these different ways, seem most likely to be successful at creating competition in the Chinese context, keeping in mind the continuing

[10] "China Modernizes Public Utilities," background paper, Third International Forum on the Reform of China's Infrastructure: Competition Policy and Anti-monopoly in China's Infrastructure Sectors in the Context of China's WTO Accession, October 2001.

[11] Mark Graham, "China's Wild West," *Industry Week*, March 5, 2001; Tim Fischer, "The Great Railway Revival," *Business Asia*, July 2001.

[12] Wu and Nash (2000) provide both a useful description of the Chinese railway system as of the mid-1990s and a valuable discussion of a range of reform proposals.

and critical needs of the Chinese railway system for increases in capacity for the foreseeable future. Finally I will discuss the different proposals in the context of plans for a "New Silk Road," a Trans-Asia Railway or "landbridge" that would connect Japan and coastal China with Europe.

2. Railway Reform: The Menu of Options

In considering the various alternatives available for railway reform and liberalization, let us begin by distinguishing between arrangements that rely fundamentally upon single companies maintaining control of both railroad track and the trains running over the track -- vertical integration -- and arrangements that rely fundamentally upon competition among different train operating enterprises over a single set of track -- partial or complete vertical separation. The former arrangements generally characterize railroad operation in North and South America, while the latter are associated, though so far as much in design as experience, with European railroads. I will describe in more detail several specific variations of these arrangements that have been implemented or proposed, giving each a country label that I think most closely approximates the system of railway organization in that country.

2.1. Systems Maintaining Vertical Integration

The US System. In the US, as in England for the first century or so of rail operation there, private railroad companies own both tracks and the trains that run over them. A particular location may be served by one or many railroads, and it is common for a pair of major cities to have two or sometimes three "parallel" railroads operating between them, competing for customers.[13] Furthermore, it is not always necessary for one railroad to serve a shipper "directly" to provide service, or to provide competition to a second railroad; depending on the characteristics of the commodity, shippers may send their goods many miles by truck or water to or from a second rail line.[14] For many commodities (especially manufactured goods) over many routes (especially shorter ones), motor carriers provide intense competition to rail carriers for the entire haul, or indeed may have already taken most of the business away from the railroads. In some locations, water carriers provide strong competition to rail. Most tariffs have been deregulated, and are set in contracts between railroads and shippers. At particular locations with multiple shippers -- such as a city -- the individual railroads may agree among each other to form a "switching area", where each railroad may run its train on each other railroad's track to reach shippers located there (or the switching area track may be jointly owned by the local government, or by the railroads that use it).

However, it is an important part of the US system that most such arrangements for "trackage rights" by one railroad company over another company's tracks are voluntary and mutually agreed

[13] In railroad parlance, the word "parallel" is not to be taken literally. Routes that are called "parallel" may be quite different and more or less direct. The important point is that they are economic alternatives for enterprises wishing to ship commodities from point A to point B.

[14] See the discussion of different commodity classes in Pittman (1990), at 30-32.

upon. "Compulsory" trackage rights, that is, access mandated by a government regulatory agency, are less common. When they do occur, they do so typically either a) as a competitive condition placed upon the merger of two railroad companies, as the regulator seeks to maintain competitive options for a particular shipper, or b) if a particular shipper can satisfy the difficult regulatory requirement necessary to prove that it is economically "captive" to a single railroad -- that is, that it has no economic alternative, via either rail or other transport mode, to that railroad for the haulage of its inputs and/or outputs. Even in those rare cases where competitive access is mandated, there may be lengthy regulatory or court proceedings to arrive at the price to be paid for access.[15]

[15] Kahn (2000); Massa (2000).

The Canadian System. Most rail traffic in Canada travels over one of only two major privately owned carriers, the Canadian National Railway and the Canadian Pacific Railway. As in the US, each railroad runs its own trains over its own track. A large amount of rail traffic flows between Canada and the US, and each Canadian railroad has various connections with US railroads for interlining traffic. Furthermore, both major Canadian railroads own significant amounts of track in the US, and two US carriers have track networks that extend into Canada. Perhaps the most important difference between the Canadian and the American systems regarding competition is that in Canada, shippers located on one of the railroads but within 30 km of the other are automatically eligible to receive either service by the second railroad over the tracks of the first or service by the first that interlines with the second, both at regulated rates.[16]

So, to be clear, what I am calling "the Canadian system" is the US system with the addition of automatic compulsory trackage rights or interconnection for a significant number of shippers directly served by only one railroad. There have been legislative proposals to establish a similar system of compulsory competitive access to captive shippers in the US, in order to obviate the need for the lengthy regulatory processes of the Surface Transportation Board, but thus far the railroads have fought them successfully.[17]

The Mexican System. When the Mexican railway system was transformed from a government owned monopoly in the period 1997-1999, it was divided into three major regional franchises -- privately owned companies, each with a monopoly in its own region -- along with one company controlling traffic between the Atlantic and Pacific ports in the South and several smaller local railroads. As in the US and Canada, each of the three main rail enterprises runs its own trains over its own (in this case, franchised) track. However, unlike in the US and Canada, in Mexico there is not much "parallel" domestic competition between different railroads: with two exceptions, there are no pairs of major cities or other economic areas where two railroad companies offer competing domestic origin-to-destination service.

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[16] Winston, *et al.* (1990), at 57; Ouellet (2000).

[17] "Past captive-shipper objectives -- none successful -- have included repealing the railroads' extensive antitrust immunity, requiring railroads to open certain single-served routes to competition and having Congress instruct the Surface Transportation Board to be more aggressive in diluting rail market power. Captive shippers say this year's legislative package currently being crafted will be more focused and emphasize objectives believed to have the greatest probability of winning bipartisan legislative support." Frank Wilner, "'We'll Work Our Tails Off,'" *Traffic World*, April 30, 2001.

What is relied upon in Mexico more than in other countries is what is called "source" or "geographic" competition. The way this works is as follows. Consider the manufacturing company that desires to send commodity X from its plant at point A to a customer at point B. Even if railroad 1 has a monopoly on rail shipments from point A to point B, and even if commodity X cannot be shipped economically by another mode from point A to point B, the shipper at A may be able to use railroads 2 and 3 to ship commodity X to other destinations, and the customer at B may be able to use railroads 4 and 5 to receive commodity X from other origins. In many circumstances -- though certainly not all -- the very fact of having these imperfect alternatives protects the shipper at A and the customer at B from monopoly abuses by railroad 1.

As the Mexican system was restructured, each of the three principal daughter corporations received as part of her dowry access to Mexico City:

- the Northeastern railroad, connecting Mexico City with the US border at Laredo, with the ports of Tampico and Veracruz, and the city of Monterrey;
- the North Pacific railroad, connecting Mexico City with several other US border points west of Laredo and with the cities of Guadalajara and Monterrey; and
- the Gulf railroad, connecting Mexico City with the Mexican Gulf Coast, including the Gulf port cities of Coatzacoalcos and Veracruz.[18]

Thus shippers in Mexico City -- which, as in the US model, is a jointly operated "switching area" -- can choose among three different rail carriers for either sending or receiving freight. (See Figure 1.) This choice is especially meaningful because so much of the rail traffic in Mexico is international traffic, and different railroads leave Mexico City to serve different ports and different US connecting railroads. Thus if one railroad charges excessive rates to Laredo, a Mexico City shipper may be able to use another railroad to reach a Gulf port, since the ultimate destination was Atlanta or New York or São Paulo anyway.

It is clear that source competition is not a perfect substitute for parallel competition. As noted, a significant portion of Mexican rail traffic is import/export traffic, where the shipper and receiver of freight may be able to choose among several different ports and border points; viewing such routes in their entirety, the Mexican portions of the trips are really portions of "parallel" route competition. But domestic shippers of domestic products presumably place a higher value on getting their product to or from a particular location. On the other hand, there is very little disagreement that in practice source competition significantly limits the monopoly power of a railroad, even for domestic shippers of domestic products.[19] The very fact that railroad 2 can offer to carry a shipper's traffic provides that shipper with leverage in dealing with railroad 1, even if the two railroads go to different places. Correspondingly, the very fact that railroad 4 can offer to deliver a particular good to a customer provides that customer with leverage in dealing with railroad 3, even if the two railroads originate in different places.

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[18] OECD (1998), at 109-112; Garcia de Alba (2000).

[19] See, *e.g.*, MacDonald (1989).

Again, to be clear, what I am calling the "Mexican system" is the US system but with a principal reliance on source competition rather than parallel competition to provide shippers with economic alternatives.

The railroads of the principal other large North and South American economies were restructured without competition high on the list of priorities. The restructured Argentine and Brazilian rail systems are made up of vertically integrated rail enterprises, as usual for countries in the Americas, but these are not structured in such a way as to create much parallel competition; nor do they protect shippers served by single railroads to the degree that the Canadian system does, at least not as so far implemented; nor do they contain the potential for source competition to the degree that the Mexican system does. To a large extent the enterprises that make up these two railroad systems are more accurately called vertically integrated regional monopolists.[20]

2.2. Systems Using Partial or Complete Vertical Separation

Let us now consider two models of railroad restructuring that provide for competing train operators on a monopoly track. This model of creating competition "on the rails" has broad conceptual appeal, and it is under serious consideration in a number of countries. It is identical conceptually to the "unbundling" of the natural monopoly bottleneck from related competitive markets that has taken place or been proposed in the electricity and telecommunications (and other) sectors throughout the world.[21] As in these sectors, however, the idea of unbundling raises many complex issues, and in particular one difficult decision: whether the owner/controller of the natural monopoly bottleneck -- in this case, the track -- is to be permitted to operate in the competitive sector of the market -- in this case, the trains.

If the answer is yes -- if nonintegrated train operators are to compete with a vertically integrated train and track enterprise -- there may be a serious problem of favoritism and discriminatory access (as well as cost shifting to evade any remaining rate regulation). Preventing the track owner from providing more favorable access terms -- regarding either price or quality -- to its own, integrated train operation than to competing train operators may require both more knowledge than the regulator is likely to have and more extensive intervention in the day-to-day operations of the railroad than the policy maker is likely to desire.[22] Furthermore, if favoritism cannot be effectively prevented, it will be that much more difficult to create effective competition in the "competitive" sector. One US example that suggests caution is the trackage rights arrangement

[20] For Argentina, see Kohon (1995) and Kogan (2002). For Brazil, see Estache, *et al.* (2001).

[21] Newbery (1999). I discuss some of these common issues in Pittman (2001).

[22] The most recent World Development Report of the World Bank, *World Development Report 2002: Building Institutions for Markets*, discusses the importance of limited regulatory capacities when designing policies for infrastructure reform in developing economies. See also Pittman (2001), *ibid.*

imposed by the Surface Transportation Board on the merger of the Union Pacific and Southern Pacific Railroads, whereby the Burlington Northern/Santa Fe line was given access over the merged railroad's lengthy "central corridor" route from the Midwest to California. As of this writing, the "tenant" railroad, the BNSF, carries only about five percent of the traffic on this route.

On the other hand, if the answer is no -- if the track owner/operator is *not* permitted to be vertically integrated into the business of running trains -- there are other problems raised. First, there is the loss of economies of scope.[23] These may have partly to do with train scheduling and coordination, but much more important in the Chinese context of a rail system already operating at full capacity may be the question of investment incentives. Serious questions are being raised, not only in the railroad sector but also in other sectors where unbundling is a possible reform option, as to whether the owner/operator of the remaining monopoly asset -- in this case the rail infrastructure -- will receive the proper signals and incentives for investments if it does not also participate in the competitive sector -- in this case the trains. If not, the network may be slow to respond to opportunities for growth, and maintenance may not be directed to the most appropriate locations or equipment (leading in the rail sector to the possibility of increased accidents).

Second, there is the problem of sequential monopoly. With the economies of scale that characterize train operation, it seems unlikely that there will be many train operators operating over a single geographic corridor.[24] This means that, in addition to the monopoly power which we assume accrues to the owner/operator of the track, there may be monopoly (or oligopoly) power enjoyed by the train operator as well. Economic theory suggests that the result of a monopoly downstream firm

[23] Ivaldi and McCullough (2001) find significant cost complementarities between track ownership and train operation, as do Bitzan (1999) and Bitzan (2000).

[24] The econometric results of Ivaldi and McCullough (2001) lead them to conclude that "even if railroads were separated into operational and infrastructure entities, the firms would still experience operational returns to density and (like airlines) would enjoy large market shares....An open access regime would not necessarily lead to competitive outcomes." Freebairn (1998) reaches the same conclusion in his study of Australian railroads: "Given likely scale economies associated with maintaining a range of services, with marketing, and the size of trains relative to current and prospective demands, it seems likely that a few operators, rather than many, will dominate most lines, and in many of the intrastate lines there may be just one train operator."

paying a monopoly price for the upstream product and setting its own monopoly price on the final product will be a higher price than that which would be set by an integrated monopolist.[25] Even without this conclusion, if structural separation does not create competition among train operators, one may ask what is the point of the whole, complex, and expensive exercise.

[25] Tirole (1988), at 174-175, citing Spengler (1950).

Finally, either of these models will require a complex operating agreement between the track owner/operator and whichever train operators it does not control. The terms of service required by a train operator desiring track usage -- like those of an electricity generator requiring long distance transmission access -- are multifaceted and complex. The contractual relations between the two enterprises are likely to be correspondingly multifaceted and complex. An entire set of transactions that takes place *within the enterprise* in the US, Canadian, and Mexican systems must take place *between two independent enterprises* under this type of system. It is not completely clear how workable such a system will be, especially in a country like China where the legal institutions for the support of private contractual relationships are still being developed.[26] An example of the possible difficulties created comes from the UK, where a serious accident followed vertical separation, and a controversy developed as to whether the problem was the state of the track in that area or the state of the wheels on the train.[27]

Let us consider separately two real-world models.

The EU System. The countries of the European Union have, like China, traditionally had unitary, monopoly, state-owned railroads. However, as a result of EU Directives 91/440, 95/18, and 95/19, each member country will in the future be obligated to a) separate the cost accounting records of the track and other infrastructure from that of the train service, and b) allow use of the infrastructure by "international groupings of railway undertakings" and "railway undertakings engaged in international combined transport of goods throughout the [EU]." The hope is to further unify the market, by providing "seamless" transborder rail shipments within the Union, in much the same way the railways are relied upon to facilitate economic integration in the large territories of China, India, and Russia -- and have been in the past in countries as diverse as the US and Romania.[28]

The new system is not in place yet. It is not completely clear just what kinds of enterprises will and will not be allowed to use the infrastructure under the stated conditions. However, the overall idea is clear. At least for the foreseeable future, train operators and track companies will be allowed to remain vertically integrated. Under certain circumstances they must permit other train operators to operate over their track, presumably under regulated rates and conditions. The

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[26] See, *e.g.*, Cao, *et al.* (1999); Zhang (2000); and Lin (2001). (A less pessimistic view is argued by Pei [2001].) Chris Nash made this point regarding rail reform in Eastern Europe at an OECD Conference on Competition and Regulation in Network Infrastructure Industries in Budapest in 1994. As recorded in the conference volume, Professor Nash argued that "the operation of the new system requires good contract law and a huge amount of legal effort. One hundred new companies are being created that must interact intimately with each other. Nash wondered if even the United Kingdom -- much less Eastern Europe -- is ready to run its railways as a laboratory test of Oliver Williamson's *Markets and Hierarchies*."

[27] Preston (2002).

[28] See, *e.g.*, "Europe Moves Closer to 'Single Railway System," *International Railway Journal*, June 13, 2001. For the US, see Stover (1961); for Romania, see Kellogg (1995).

separation of the accounts within the vertically integrated operation is intended to insure that the integrated train operator pays the same rates for track access as does an independent operator.[29]

The broader intent of those who seek to implement an EU-style system in other countries is typically to provide shippers with competitive rail service while not losing the economies of scope that come from joint operation of the train and the track. (It is not clear yet to what degree the system will achieve this goal in the EU itself, since the train operators given mandatory access to the track in any particular country must apparently be *international* train operators.) Many supporters of this system believe that the mere *potential* for (for example) shippers of large volumes to provide their own train service over the monopoly track will be enough to force the rates of the integrated enterprise down to a workably competitive level. Regulation would then be required for terms of access to the infrastructure but not for train service itself.

[29] See, *e.g.*, "DB to Remain an Integrated Railway," *International Railway Journal*, October 3, 2001; Perkins (2002).

The UK System. The UK has chosen the second version of the "many trains, one track" model: it has separated the ownership and control of the track and the operation of the trains into two completely independent enterprises, with the intention of encouraging competitive train operators to enter the market.[30] The track company, Railtrack, provides access to both freight and passenger trains at a regulated tariff level.

Again to be clear, the difference between what I am calling the EU system and what I am calling the UK system is that in the former the track owner/operator is permitted to be a train owner/operator as well, while in the latter it is not. Otherwise the intention of those who support these models is usually the same: to allow for competition among different train-operating enterprises over a single monopoly track.

3. China, Choosing among the Alternatives

As noted earlier, most analysts would probably agree on a certain bare minimum set of requirements for a liberalized Chinese railway system to operate in a more efficient and productive manner: flexible local or regional setting of tariffs, flexible local or regional train scheduling, an end to system-wide revenue redistribution, more separation of passenger from freight operations, and complete separation of the ownership and regulatory functions. Beyond these -- which certainly merit discussion on their own -- let us consider how the systems that just described for creating railroad competition may be applied in modern China.

[30] It is interesting to note that the UK is returning to the system that was envisioned when the first railways were built in the UK and the US. "The first projectors of the improved modern railways contemplated themselves only as proprietors of the lines. They intended to make a road, and to offer it to the public to be run upon, all persons having the means of transport upon it, paying them a toll for its use. The railways, however, had scarcely come into operation, when it became glaringly manifest that this analogy to a common road was altogether destitute of foundation, and that the new instrument of transport must be worked upon principles, and by methods, totally different. It became evident, in a word, that the proprietors of the road must themselves become carriers upon it; the unity of management, and the harmony of movement, indispensable to the efficient action of its peculiar mode of transport, rendering this indispensable." Lardner (1850), at 107-108. Simmons and Biddle (1997, at 328) believe that the critical factor making the "public toll road" model infeasible was the introduction of locomotives, "for few of the carriers would own such machines."

Let us note first of all that intermodal competition, wherever it can be economical, provides clear protection to shippers from monopolistic behavior by a railroad. Both road freight transport and river freight transport tend to be industries that can be structured as reasonably competitive,[31] so that where they are economically feasible they can by themselves provide competitive transport alternatives to shippers and obviate the need for regulation. The Chinese government should do everything possible to encourage the development of intermodal competition, for example by

- liberalizing private entry into motor and water carriage,
- providing the necessary road and water infrastructure for the use of private operators,
- protecting competition in the procurement policies of governments at all levels, to ensure that infrastructure investments get the best results possible, and
- insuring that tax policies -- for example on fuel use -- do not discriminate against particular transport modes.[32]

However, regardless of any such policies, China is a large country whose economy includes large volumes of commodities that travel most economically by rail, particularly coal and different metallic and nonmetallic minerals. Competition *among railroads* must be created if most of these shippers are to have competitive choices. Let us consider the possibilities.

[31] This is more true for truckload road haulage than it is for less-than-truckload road haulage, where the creation of a hub-and-spoke network may yield significant economies. But truckload road haulage is the more relevant of the two as a competitor for rail.

[32] The analysis of Yi-min Lin (2001) is relevant here and is not encouraging, particularly regarding the latter two points. Lin argues that the combination of increased economic competition, increased local government autonomy, and the increased commercial connections of local government bodies and officials has corrupted the procurement process and skewed the incidence of taxes, regulations, and other fiscal burdens (called “tanpai” or, more generally, “san luan”) for or against particular private enterprises. For one industry example, see Zhou (2001).

The US, Canadian, and Mexican systems constitute the three principal methods that have been used to provide freight shippers with competitive rail options while still maintaining a system whereby most rail traffic consists of a particular company running its own trains over its own (or franchised) tracks. In all three countries there is some regulatory protection available for "captive" shippers; nevertheless, in all three countries most traffic moves on non-regulated tariffs using non-regulated shipping arrangements. Competition is not perfect, but it is "workable". This has resulted in a much reduced presence for the rail regulators of these countries. At the same time, railroad sector reform has been accompanied by falling real tariffs and increasing rail sector profitability. Broad deregulation of the US rail sector has resulted in sizable welfare gains to shippers, railroad companies, and the overall economy.[33] The reorganized Mexican rail sector has moved swiftly from receiving government subsidies of US$400 million every year to paying taxes of US$24 million every year. Just as important for the Chinese application, the three private concessionaires in Mexico are investing hundreds of millions of dollars each year in their systems.[34]

Some form of the EU system is widely advocated in current railroad policy debates around the world, and for good reasons. Increased transparency, which it provides, has benefits both economic and political. Potential or even actual intramodal competition, which it also provides, can in general be a powerful force to prevent monopoly abuses. It seems a perfectly good idea to require the Chinese railways to keep separate accounts for their track and train operations, and to require them to "charge" themselves a reasonable, regulated tariff for track access, so that it may be possible in the future for shippers of large volumes to either supply their own long-distance rail transport, or to threaten to do so. As I will discuss below, this will also be important if one or more Trans Asia Railway routes are to be economically effective.

However, it is important to keep in mind the limitations of new regulatory agencies in developing countries. As in other infrastructure sectors where some version of unbundling is under consideration, in the railway sector the charge for access to the network must vary a good deal by time, place, and customer if economic efficiency is to be served while the network covers its costs. A well functioning vertically integrated rail enterprise will impose this variation internally, and often implicitly, but with unbundling these charges must be set explicitly, and subject to regulatory oversight to prevent discrimination. A new Chinese regulatory body is not likely to have the knowledge or enforcement capability necessary to ensure that a tariff for access to rail infrastructure is set at the correct, efficient level in hundreds of different situations around the country -- even assuming there were agreement among economists on the appropriate conceptual framework.[35] The

[33] Barnekov and Kleit (1990); Winston (1993); MacDonald and Cavalluzzo (1996). Organized labor may have been a loser in the process, both in the rail sector and in the competing long-haul trucking sector.

[34] Garcia de Alba (2000). The private concessionaires in Brazil are similarly investing heavily in their infrastructure (Estache, *et al.* [2001]).

[35] Compare the "global price caps" solution of Laffont and Tirole (1994) with the "efficient component pricing rule" of Baumol, *et al.* (1997).

EU system may provide *some* protection for *some* large shippers, but it seems clearly to require much too much regulatory knowledge, enforcement, and intrusion into day-to-day enterprise management to be relied upon as the primary source of rail competition for shippers in today's China.

In addition, there is the question of whether economies of scale in train operation are so important that opening up the train sector to entry will not result in much competition anyway. The government of the Netherlands has just announced the failure of its attempt to implement an EU style system within its country, designed to encourage rival train operators to compete with the vertically integrated national operator NS. The *Financial Times* reports of "years in which attempts to introduce competition led only to a sharp deterioration in the train service," and notes that "as rival regional train operators came and went, establishing no strong presence, the NS was left with a virtual monopoly."[36] Perkins (2002), writing before the abandonment of the experiment, writes of "the current crisis (deteriorating punctuality, overcrowding, delays in rolling-stock procurement, maintenance backlogs, inability to manage industry interfaces) in the vertically separated and fragmented Netherlands railway system."

The same issues arise in the context of the UK system, which requires complete enterprise separation between the track owner/operator and all train operators. It is true that such a system would seem to require less strict regulation of access terms than the EU system, since there should be no reason for the track owner to discriminate among different train operators. To the degree that the former monopoly train operator maintains market power, however, it may be able to demand and achieve access terms better than those available to market newcomers, and thus vigilant regulation remains important. Furthermore, even to the degree that demands on regulators are reduced, this advantage may be outweighed by the additional contract negotiation and enforcement that a system of complete separation requires, in a legal system which is not prepared for this burden. Finally, of course, there is a complete loss of economies of scope between train and track operators.

[36] Gordon Cramb, "Netherlands Abandons Rail Competition," *Financial Times*, January 3, 2002.

Like the EU system, the UK system is at this point essentially an experiment. There are some early positive signs in the UK itself, such as the real benefits of the introduction of competition into the markets for maintenance, equipment, and supplies, some indications of reduced operating costs, and continuing increases in freight and passenger traffic levels.[37] Similar reorganization plans in Sweden and Romania have shown some promising signs as well, though a) the Swedish system sets infrastructure access charges at marginal cost, thus making no attempt to recover from users the full cost of providing the network, and b) the Romanian system is still quite new, with a small number of market entrants accounting for a very small share of traffic so far.[38] Overall, however, the experience to date with this system in the UK is one of controversy, confusion, and failed hopes. There have been several serious accidents, and Railtrack recently declared bankruptcy, admitting that successful reorganization would not come any time soon.[39] Critically in the Chinese context, attempts to encourage private investment in the UK rail infrastructure have so far failed.[40] At this point the UK, "open access" system seems even less promising as the foundation for competition on the Chinese railways than is the EU system.

This brings us back to the three North American systems. Experience suggests that "parallel" rail service between origin and destination points provides the best economic alternatives for shippers who depend on rail, requiring a minimum of close regulatory supervision and intrusion. To the degree that there are rail routes in China where there is sufficient "parallel" track that a restructuring to create the US system could be feasible, policy makers should consider introducing this option in those areas. Two examples, perhaps suitable for early policy experiments, might be:

- Beijing to Kunming, where what I label below the Southwestern and South Central routings could compete directly for traffic. However, there is not a great deal of

[37] Pollitt and Smith (2001); Preston (2002); "Britain Announces £67 Billion 10-Year Rail Investment," *International Railway Journal*, January 17, 2002.

[38] Ekström (2002); Ioan Mihaila and Ileana Statie, "Interests in Making Railway Traffic More Efficient," *Railway Journal* (Bucharest), April 2001; Oana Bran, "Harmonization of the Railway Transport to the Current Requirements," *Railway Journal* (Bucharest), September 2001.

[39] Rosemary Bennett and Juliette Jowit, "UK Railways Face Further Year of Troubles," *Financial Times*, January 10, 2002. They report the estimate of the German-backed company bidding to take over Railtrack that "it would be August 2003 before the company could be taken out of administration." More recently, the newspaper reports that "Railtrack managers believe the company could need another £6bn or more to maintain and renew the network up to 2006 because track and signalling are in much worse condition than previously thought." Juliette Jowit and Chris Giles, "Byers faces £10bn railways shortfall," *Financial Times*, March 4, 2002. See also "Railtrack Collapses," *International Railway Journal*, October 8, 2001, and David Pringle, Masayoshi Kanabayashi, and William Boston, "Experience of British Rail System Serves as Cautionary Tale," *Wall Street Journal*, October 17, 2001.

[40] Juliette Jowit, "First Private Rail Project is Halted," *Financial Times*, March 31, 2002: "The first of a new generation of private rail infrastructure projects has been disbanded, in an embarrassing blow to government hopes they would deliver billions of pounds of investment in the industry over 10 years."

traffic flowing between these two points.

- Beijing to Harbin, where a direct routing could compete directly with trains operating via Shenyang. Traffic flowing between these two points is somewhat greater than that between Beijing and Kunming, and the distance of haul, though not as great, is in the range of 1,000 km, far enough that significant portions of the traffic are likely not to be hauled economically by motor carrier.

Recall also that "parallel" railroad lines need not always serve shippers directly in order to provide "parallel" competition; depending on the commodities involved, a shipper may be able to carry freight by truck or water to a second railroad in order to get a better rate than that offered by the closest railroad. (This is especially the case if neither railroad serves the shipper directly, so that the freight must be loaded on a truck for hauling to a rail line in any case -- often the case with agricultural commodities.) It seems likely that

- The Southeast (Beijing to Shanghai), South Central (Beijing to Guangzhou), and Southwest (Beijing to Kunming) lines could compete to offer parallel service for many shippers located between pairs of these lines.

In fact, it appears that in the early part of the 20th century, portions of the precursors to the Southeast and South Central lines competed with each other for service. In his discussion of the Tientsin-Pukow (my Southeast) and Peking-Hankow (my South Central) Railways, Hsu (1915) notes that "at the present these are the only two lines in China which may be said to have to face the problem of competition as found in other countries."

Some of the shippers who remain "captive" to a single rail carrier within these geographic corridors could perhaps be protected under something like the Canadian system, where the railroad serving the shipper must provide access or connecting service to the nearest alternative railroad.

So: parallel rail competition for some shippers located in the right places, regulatory protection for some shippers who remain captive to a single carrier, perhaps potential entry into long-distance haulage of their own commodities by some of the largest shippers. What of the others?

Here the Mexican system seems worth a serious look. The central idea behind the Mexican system -- "source" or "geographic" competition -- has been shown for more than a century in the US, Canada, and the UK to be an effective constraint on railroads that would otherwise have monopoly power.

How would it work? In those areas where parallel railroad competition is not feasible, the most important locations for rail origins and/or deliveries would be determined. Those with track that currently carries significant amounts of freight in at least two different directions would be considered as candidates for the creation of source competition. The data available are not detailed enough to draw up a serious and comprehensive proposal, but a look at some aggregated traffic flow data suggests that such a list might include Beijing, Shanghai, Lanzhou, Zhengzhou, Changsha, and

Kunming, perhaps Shenyang and/or Jinan. The railway enterprises would be reorganized and restructured so that each of these cities was served by at least two, and perhaps more, independent, vertically integrated rail enterprises. The following separations might be among those considered:

- from Beijing, competing rail enterprises heading Northeast to Shenyang and Harbin, Southeast to Shanghai, South Central to Guangzhou, Southwest to Lanzhou, and West to Lanzhou and Urumqi. These routings are outlined in Figure 2. As noted above, the South Central and Southwest lines could perhaps compete head-to-head for traffic between Beijing and Kunming.
- from Shanghai, Northwest to Beijing, Southwest to Kunming (connecting with the South Central Beijing-Guangzhou line at Changsha), and West to Lanzhou. These routings are outlined in Figure 3.
- Zhengzhou would benefit from competition between trains on the Shanghai-Lanzhou route and trains on the Beijing-Guangzhou route. In addition, one could consider separating either of these two lines at Zhengzhou to create more source competition there.
- Changsha would benefit from competition between trains on the Shanghai-Kunming route and trains on the Beijing-Guangzhou route. In addition, one could consider separating either of these two lines at Changsha to create more source competition there.
- Lanzhou would benefit from competition between trains from Shanghai and trains on the Beijing-Urumqi route. In addition, one could consider separating the latter line at Lanzhou to create more source competition there.

The combined set of vertically integrated rail enterprises under this proposal is outlined in Figure 4. The overall number of independent rail enterprises under a more comprehensive proposal might or might not be smaller than the current fourteen rail administrations; I do not pretend to know the optimal number. It is worth noting, however, that a restructuring proposal along the lines outlined here would not be an exercise in atomizing the system in order to create competition. We spoke earlier of the economies of density in railroad systems, but another measure of economies of scale in railroading is the economies of network size. Using data on Western European rail systems, John Preston estimates that operating costs achieve a minimum in the neighborhood of a track network size of 3,000 to 4,000 km.[41] There is no reason to think that one should apply this number mechanically to the Chinese rail system and propose to divide its 68,700 km into seventeen to twenty-three companies, but the exercise does suggest that many separate vertically integrated rail enterprises could be created in China at a scale comparable to those operating at efficient levels in other countries -- and that a system based on the plan suggested here would not be unrealistic.[42]

[41] Preston (1996); Preston (2001). The results of Bitzan (2000), using data from US Class I railroads, are more difficult to interpret, but would seem to suggest a considerably higher system size figure for achieving minimum system costs, perhaps 4000-4500 miles (about 7000 km). This in turn would suggest an optimal network division of about 10 rail enterprises. See also Bitzan (1999).

[42] The figure of 68,700 km is as of the end of 2000; this number is already increasing. See Development Research Center (2001).

Shippers at each of the listed rail origin/destination points would have at least two choices of rail carriers. (I am not addressing reorganization for those areas where I see no obvious possibilities for introducing geographic competition.) The track directly serving shippers in each city would be reorganized as an independent or joint venture switching area, with an independent or jointly appointed dispatch unit scheduling and supervising train operation. And the competition provided -- again, not "perfect", but likely "workable" -- should dramatically reduce the need for close regulatory supervision of the railroad enterprises. According to the most detailed shipments data available, the separate rail enterprises created in the first two categories above would provide at least two-railroad geographic competition for cities accounting for about half of China's rail freight traffic.

As with the proposal above for parallel rail competition, there is precedent for this plan for source competition in Chinese history (though in this case only proposals, not their enactments). First, sometime around 1910, Tsen Chen-hsuan presented a memorial to the Manchu throne proposing a system of four trunk lines radiating from Peking (Beijing):

> "I. The Northern trunk line, running from Peking through Kalgan, Kulun (Urga) and then to Kiachta in Mongolia.
> II. The Eastern trunk line, made by extending the present Peking-Mukden line to Aigun via Chiaonan and Tsitsihar in Manchuria.
> III. The Southern trunk line, beginning from Peking and ending at Canton via Hankow, *i.e.*, the Peking-Canton line when completed.
> IV. The Western trunk line, formed by extending the line between Chengting (on the Peking-Hankow line) and Tayuan which will join with the Tungpu Railway, to the West via Tungkwan and Lanchow, and ultimately entering Ili."[43]

Only a few years later, Sun Yat-Sen proposed, in addition to a system of east-west trunk lines covering the country, a network of seven lines "radiating fan-wise from Canton to every important city and rich mine in the Southwest," *i.e.* "from Canton to Chungking, Kweiyang, Chengtu, Kunming, Kweilin, Szemao near the Burma border, and Yamchos on the Gulf of Tongking."[44]

Finally, we should not discuss restructuring the Chinese rail system without at least noting the important early stages of organization of several variations on a Trans Asian Railway, or "New Silk Road." Such a route or routes could, if operated with efficiency, cut days and hence significant costs off the water route from East Asia to Europe, and in the process provide valuable transit fees for any Chinese railway lines that were part of the route. Among current routings reportedly being considered are:

- one that would originate in both Dandong and Shenzen and travel through Beijing

[43] Hsu (1915) at 131.

[44] Chang (1943), at 51.

and Erenhot before passing through Ulaan Baatar and Mongolia and then into Russia,[45]

- one that would originate in Lianyungang and travel through Urumqi before passing through Drujba and Kazakhstan and then into Russia,
- one that would originate in North and South Korea and move into China on the way to an intersection in Russia with the Trans-Siberia Railroad,[46]
- somewhat different in focus, a Southern Corridor route that would begin in Kunming and travel through Southeast Asia, India, Pakistan, Iraq, Iran, and Turkey,[47] and
- further different in focus, a line from Kunming through Hanoi, Phnom Penh, Bangkok, and Kuala Lumpur, terminating in Singapore.[48]

Assuming that the routing or routings involved have the capacity to handle these long-distance, high-speed train movements, there is nothing but good for China in these plans, starting with the rail access fees that will accrue. The likelihood and desirability of this traffic is another good reason for the Chinese rail enterprises to institute separate accounting for track and train operations. However, these trains are unlikely to focus much on intra-China traffic, so vertically integrated rail enterprises should lack the incentive to discriminate against them. They should thus not create serious regulatory problems.

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[45] "A Brief Introduction to Dandong," http://www.chinamarket.com.cn/C/invest/area/dandong/tzhj-1e.html.

[46] "How Korea's new railroad will change NE Asia," *Asia Times*, August 1, 2000. Another possible routing would be an All-Russia line originating in Vostochny. See http://unescap.org/tctd/tar/Face-Maps.html and "Trans-Asia Railway Making Its Way," http://www.lonelyplanet.com/scoop/asi/mal.htm.

[47] Victoria Lavrentieva, "Putin OKs Iran-India Cargo Corridor," *Moscow Times*, March 14, 2002.

[48] "Poor ASEAN states to get loans for railway project," *Asian Economic News*, November 27, 2000; Bruce Gilley, "All Aboard," *Far Eastern Economic Review*, December 14, 2000. Gilley notes that "of the 5,500-kilometre network from Singapore to Kunming ... , 4,500 kilometres already exist in various states of repair as part of national railways. The project is intended to link them, upgrade them, build new spurs, and make the whole system function as one."

All of this is just one very rough set of ideas for a possible reorganization of the Chinese railway system. As noted, the detailed data necessary to formulate a plan in which one could have confidence are not yet available. There may be good reasons why some aspects of the plan presented here would not be workable, and there are clearly plenty of reasons why one might wish to set up some subset of these arrangements as experiments before adopting a plan for complete system reform. Nevertheless, with the information available, this seems like the kind of alternative reorganization that deserves serious consideration. Although it would certainly involve some transition costs as the current railroad enterprises are restructured, it should require much less day-to-day regulation than some alternative reform plans, while still both a) providing many shippers with the advantages of competition between two independent rail enterprises, and b) largely maintaining vertical integration of railway enterprises, with the more straightforward operating environment and more efficient maintenance and investment incentives that such integration seems to provide.

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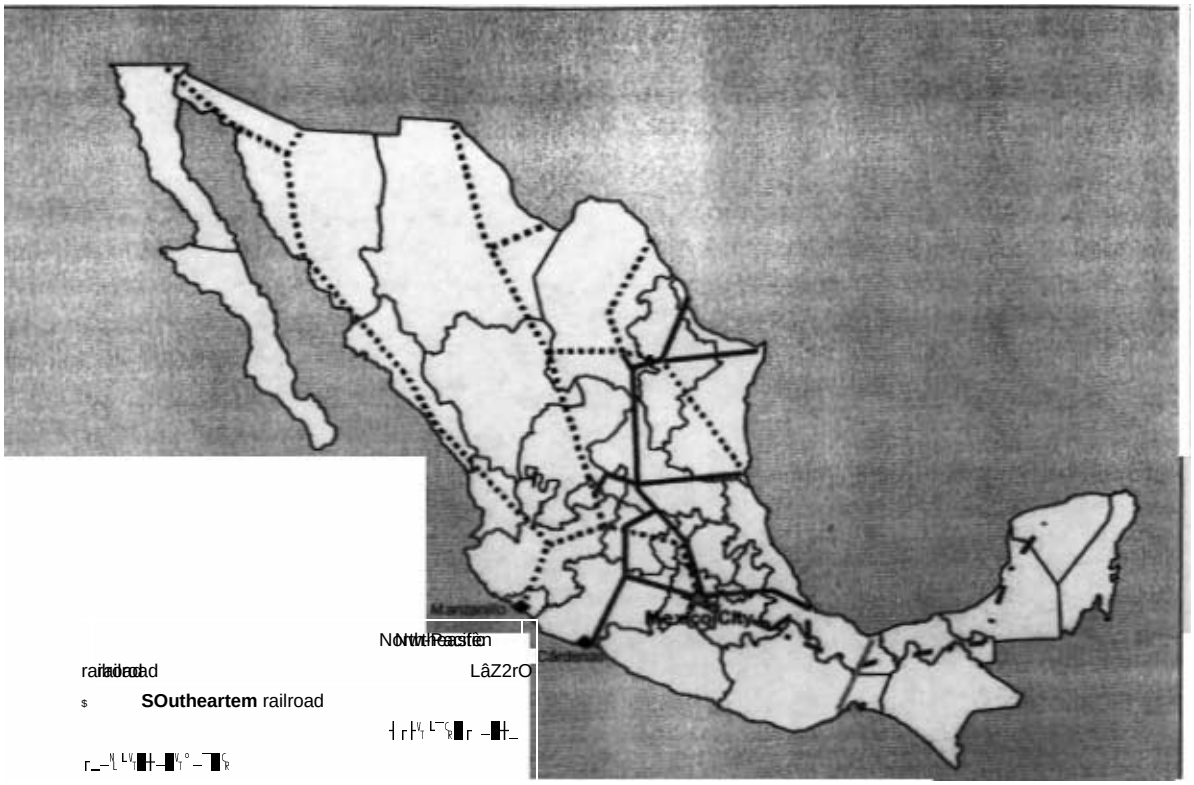
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Figure 2. Five vertically integrated rail enterprises centered in Beijing.

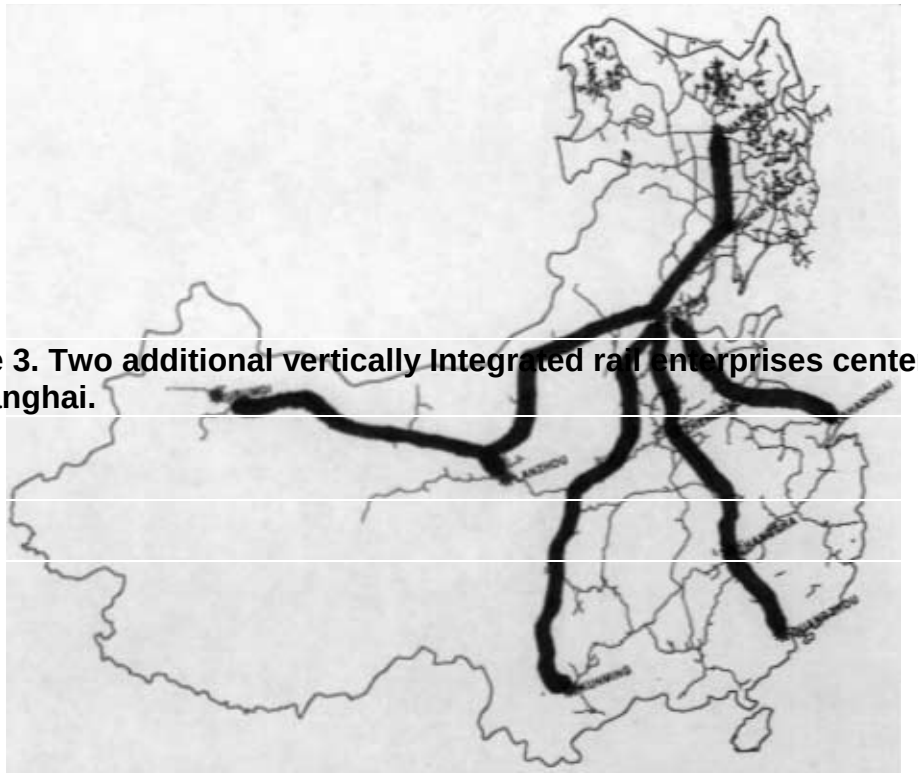
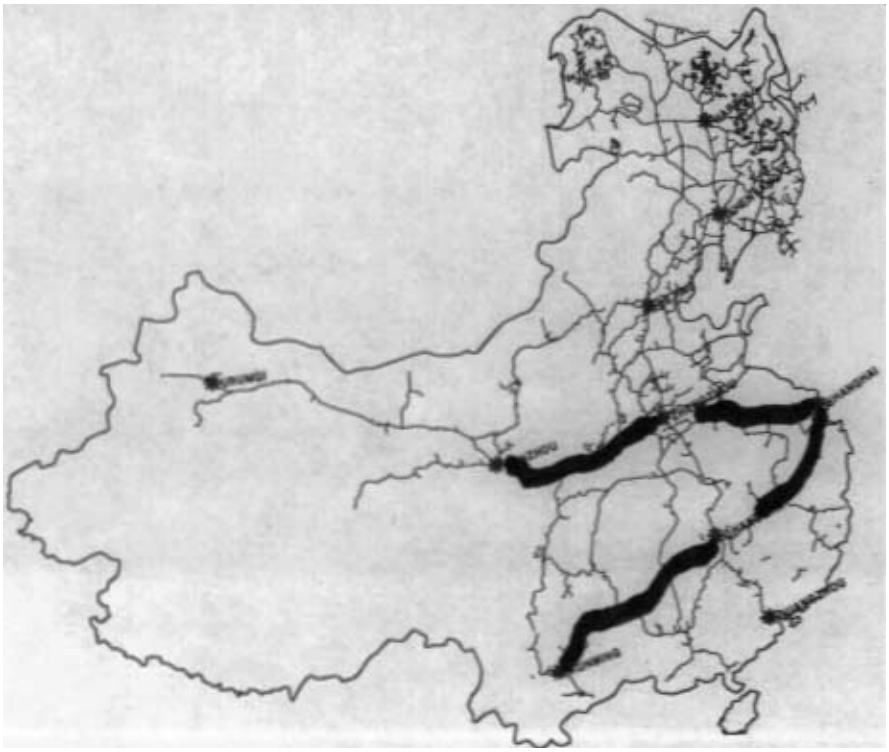


Figure 3. Two additional vertically Integrated rail enterprises centered in Shanghai.



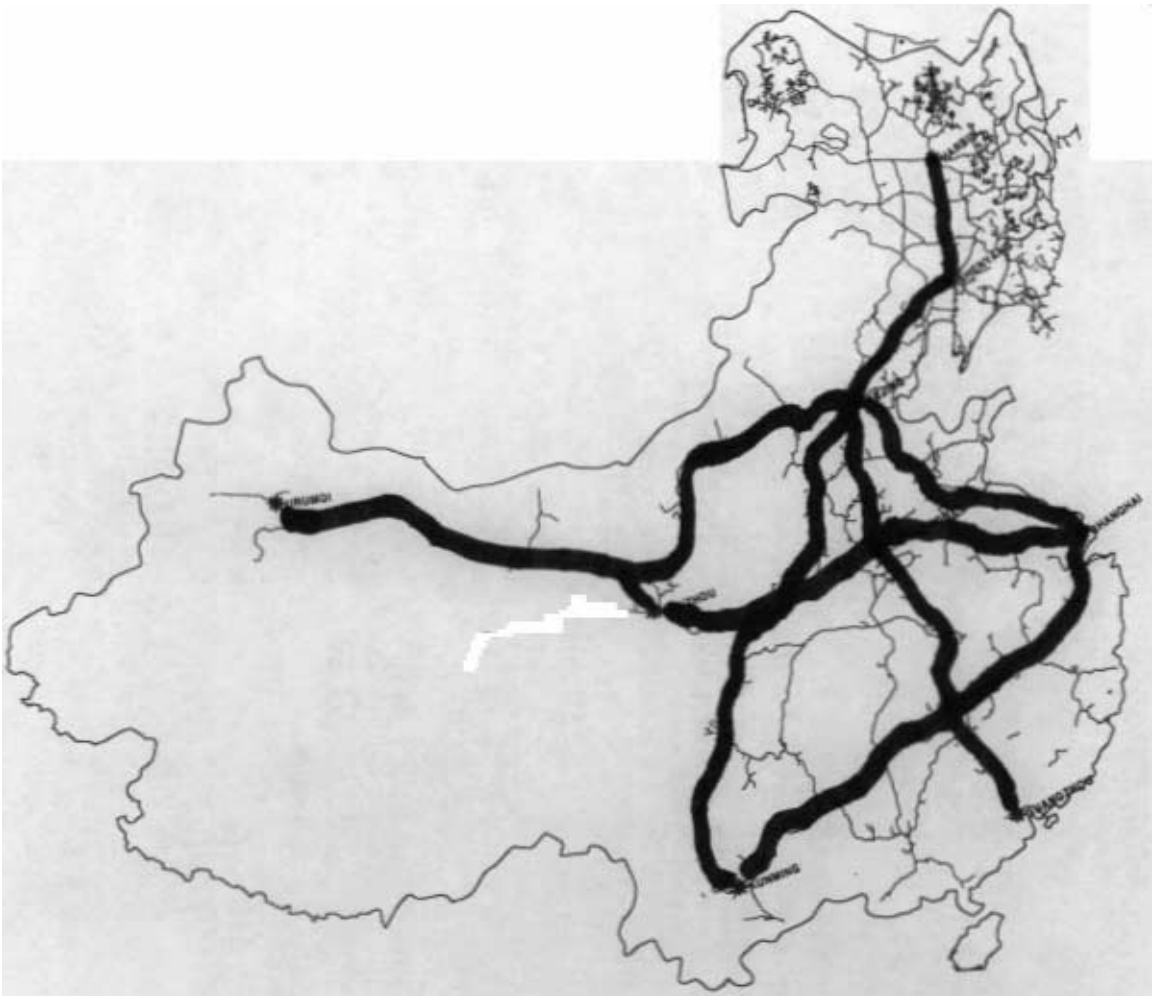


Figure 4. Seven vertically integrated rail enterprises providing geographic competition for shippers.

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