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RAILWAY REFORM IN CHINA

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CONTENTS

Abstract

The purpose of this working paper is to consider the current situation of Chinese Railways, the progress of reforms to date, and possible future developments. The first section describes the current problems of Chinese Railways, as a vast organisation subject to strong central control, facing enormous and rapidly growing demands which it is unable to satisfy. The progress of reform in Chinese Railways to date, and in particular the Economic Contract Responsibility System instituted in the late 1980's and the development of joint venture companies to build new lines, are then described. In the following section the key reform models found in other countries – deregulation and privatisation of vertically integrated regional companies; separation of infrastructure from operations with open access and/or franchising competitors; or reorganisation on the basis of business sectors – are then described. None is fully suitable for China, but it is suggested that a combination of sectorisation, more commercial independence, further development of joint public/private partnerships and more contracting out, is the most likely way forward.

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1. INTRODUCTION

Chinese Railways is one of the largest and busiest railways in the world. It has already been affected by the pressure for reform of economic institutions in China, although the changes so far are less radical than those affecting many railway companies around the world. This paper aims to describe the current position of Chinese railways and to consider how this might develop in future. The paper is divided into three main sections. In the first we outline some characteristics of Chinese Railways. We then describe the reforms that have already taken place in China. After this we briefly review the alternative models for reform of rail organisation to be found around the world, before considering how applicable these might be to Chinese circumstances.

2. INTRODUCTION TO CHINESE RAILWAYS (CR)

2.1 Physical System and the Role of Railway

Since the introduction of the reform and open door policy, and due to the effects of rapid economic growth as well as the importance accorded to it by the Government , Chinese Railways (CR) has undergone enormous changes and improvements. By the end of 1995, the total length of national railway lines reached 54,600 km (the figure is 59,634 if 5,034 km of local railways is included), of which 27% are double tracked and 15.5% are electrified while almost 90% of the total gross tonne-km was hauled by diesel and electric locomotives. By 1995, freight traffic measured in net tonne-km was 1,283.6 billion (ranking the third in the world), having increased at a 5.96% annual average growth rate since 1980, while passenger km increased to 354.3 billion (ranking the highest in the world), a 6.97% annual average growth rate since 1980. The railway plays a dominant role in the transport sector, with a market share of 54.4%(excluding international sea transport) in freight and 39% in passenger traffic in 1995 (table 1). Rail is even more important in the public transport market with a market share of 69% in freight and 56% in passenger, while in the inter-city market, its role is vital, with a market share of 70.1% in passenger traffic even in term of passenger trips in 1993.

China seems to be a country ideally made for rail transport, both freight and passenger. It has a vast expanse of land of 9.6 million square-kilometers and a large population of almost 1.2 billion people. Natural resources are mostly concentrated in the inland areas in central and west China with more than 50% of the deposits of main minerals being found in these areas, e.g. 58% of coal, 50% of petroleum, 61% of aluminium ore and 98% rare-earth ore, while the processing industries are mainly located in the south-east coast areas. For example, the average distance between Shanxi Province and Shanghai is over 1,000 km and that between Shanxi and Guangzhou is over 2,000 km. In 1995, the coal carried from Shanxi via rail was 198.07 million tonnes, of which more than two thirds was to the south-east coast areas (half directly by rail, and another half by rail to ports). Such large-scale and long distance transport of raw materials is very favourable to rail transport.

In 1993, there were 32 cities with more than one million people, 10 of them were more than 5 millions (the number will increase to 20 if including the population of counties under the jurisdiction of municipal government) . The population is concentrated, with over 70% of the population living east of a Beijing-Guangzhou line. Most of the distances between cities are in the range 200-500 km (table 2). This would imply generally moderate transport distances within its densely populated areas and an ideal area for rail to offer journey times and low prices which compete with road and air. In a country of a low GNP per capita (US$ 450 in 1994), a low car ownership (less than 1 per thousand population in 1995) and rather high population density, the intercity and inter-regional public transport flows are strong enough to support a good quality rail service.

Although CR's network has developed rapidly over the last 40 years, in terms of quantity (route km increased from 21810 in 1949 to 54616 in 1995) and quality, the density of the network is still low in comparison with that of other countries, both in terms of density per square km or per capita (table 1). The US ,which has a size almost the same as that of China, has a rail network 3.6 times as dense as China per square km and over 15 times as dense per head of population. India, with a lower income per capita also has a rail network 3.4 times as dense as that of China per unit area. The difference is even bigger, when comparison with Western Europe is made - 55.3 km /1000 km^2 and 440 km/million inhabitants.

Despite the rapid growth in passenger traffic, the mobility of people in China is still very low, e.g. the rail passenger trip per capita in 1994 was 0.90, while the levels of UK, Japan and India were 10.2, 70.5 and 4.32 respectively; in term of the rail passenger km per capita, China was 307.9 in 1994, UK, Japan and India were 500, 1955 and 352 respectively.

Because the rail network is still small in China, it is used very intensively . China has the highest traffic density in the world. As table 1 shows, the traffic units (TU) per line km of CR was 29.7 million in 1995, 170%, 128%, 1088% and 230% higher than those of US, Japan, UK and India respectively. Locomotives and rolling stock also have very high utilisation factors in comparison with other countries (table 3).

Despite the fact that rail traffic is still growing, the trends of modal shift toward truck for freight and toward road and air in passenger are underway in China now (Chart 1). This results from a number of factors (J.H. E. Taplin, 1993 and Zhao, H.P. , Wu, J.H., etc., 1997):

(a) the deregulation of the other modes, especially road since 1984, which have greatly stimulated their development. Take road for example, from 1980 to 1990, the total investment reached 6.6 bn Yuan, of which 50% came from local governments and the private sector, while during 1950 to 1980, the total investment for road was only 3 bn Yuan. At the same time the road length increased 15,000 Km per year, while the route length of rail only increased 350 Km per year. By the end of 1996, the total length of motorway in China reached 3200 kilometres. With the development of motorways and high quality roads, the number of passenger transport enterprises who run passenger business by motorway has reached 10,000. There are 7000 coach routes that span two provinces or are longer than 400 km.);

(b) a significant increase in rail passenger fares. (In 1985, the short-distance (less than 100 km) passenger rate was increased by 36.7% to induce some shift of short-haul passenger from rail to bus. In 1989, there was a 112% increase in the basic passenger rate, which caused 15.9% decrease in passenger trips in 1990. In 1995, there was another 51.8% increase in the basic

passenger rate, which caused a 12% drop of passenger trips in 1996.);

(c) the shortage of line capacity.

2.2 Traffic and its Characteristics

It can be seen from table 4 that CR has a much greater dependence on inter regional and regional passenger traffic and much lower dependence on commuter traffic than Indian or Western European railways. This may explain the quite long mean passenger journey lengths, compared with rather shorter mean passenger journey lengths for road (43 km in 1993) and very long mean passenger journey lengths for air (1412 km in 1993), and high loads exhibited by CR (table 5). Moreover, Table 4 shows that the freight mix is also favourable to CR, with there being a much greater dependence on bulk commodities, especially coal. Thus Table 5 shows that CR has the advantages of long length of haul and large freight train loads as well.

2.3 Performance

Labour Productivity

There are two main indicators used to measure the labour productivity of railways with two conceptually different outputs(Oum, T.H. and Yu, C. 1994): traffic unit per staff and train km per staff.

CR's labour productivity has improved a lot in terms of traffic units per member of staff. It increased more than 78%, from 462,000 in 1980 to 824,000 in 1995(exceeding that of all Western European railways except Sweden 1,164,000 in 1995) , with a 4.2% annual average growth rate. (Great Britain was 263,042 in 1980, 453,000 in 1995, with a 3.96% annual average growth rate). This results from a 6.25% annual average growth rate of traffic units for CR since 1980, while only a 1.92% annual average growth rate of employees, and was partly achieved by means of an increase in traffic units per train kilometre from 1064 in 1980 to 1453 in 1990. It has been suggested that a growing railway finds it easier to raise labour productivity than does a declining one (Nash, C.A. , 1985).

However, the labour productivity indicator advocated by Nash (1985) is train km per staff. Using this indicator to measure the labour productivity of CR shows a completely different story. Table 6 reveals that average labour productivity of Western European Railways in 1990 was 2926 train-km per staff, 490% higher than that of CR. Moreover, from 1980 to 1990, the CR's figure had only grown 1.68% per year , while an average growth rate of Western European Railways was 2.02% from 1977 to 1990, an average growth rate of Indian Railways was 1.83% from 1980 to 1990. This reflects CR's operational policy of using longer trains for passenger and heavier loads for freight , instead of running more trains and improving the service (frequency)level due to the line capacity constraints. This may also suggest that the operational efficiency that CR gained mainly comes from a more favourable demand side (in term of traffic growth per staff), not from the supply side by producing more trains km.

It may reasonably be objected that use of a productivity measure suited to European conditions in a country as different as China is of doubtful relevance, because there is a strong line capacity constraint in China which prevents CR running as many trains as it wants, and most importantly,

CR's trains, both passenger and freight , carry an average payload far in excess of all Western European Railways (table 5). Perhaps a comparison with North American is more relevant. Despite the fact that mean gross tonnes per train in US exceeds 4600 tonnes, 78% higher than that of CR, US Class I railroads achieved a train-km per staff figure of 3389 in 1993, 5 times higher than that of CR.

There are probably three main reasons for this low productivity.

a) overstaffing. It is interesting that, when questioned by a number of journalists on the Nineth People's Congress on the overstaffed problems in the state-owned enterprises in China, a representative of the State Council (Mr Chen Q. T.)replied: "The enterprises can be operated as well as usual if one third of staff is removed. Furthermore, it will be even better for some enterprises if half the employees are removed". This is also the case for CR;

b) CR is still used as a universal means of transport retaining large volumes of labour-intensive traffic, for example, a large amount of less than wagonload traffic;

c) outmoded facilities and equipment are common.

Commercial Performance

Table 7 and 8 present two main indicators of commercial performance. Table 7 shows that CR not only has much higher train loads than that of Western European Railways, but also experiences a real increase over time. Table 8 illustrates that CR has the lowest charges in our sample, almost 1800% less than that of BR and even more than 100% less than that of Indian Railways. In terms of increasing receipts per traffic unit, CR achieved a 6.06% annual growth rate of from 1980 to 1995 but the annual inflation rate was 8.16% so even the substantial price increases noted above left real charges lower at the end of the period than at the beginning. However, the disaggregated data reveals that Indian Railways has the lowest fares per passenger km. This may be explained by the different tariff policy that CR adopted, i.e. trying to commercialise its passenger business first (rather than maximising rail's share of the whole public transport market), instead of freight, for which rates are more tightly controlled by the central government as a tool to control the inflation.

Financial Performance

Table 9 shows the breakdown of the total costs for CR , Indian Railways and 4 large railways in Western Europe. It is obvious that CR has the lowest staff cost ratio, but the highest fuel and depreciation cost ratio in the sample. This mainly results from the very low labour cost, which can also be explained by the indicator of staff numbers per one million pounds staff costs in table 10, and the ever increasing prices (costs) in fuel and construction in China.

It can be seen from table 10 that CR, like most railways in Western Europe, was experiencing a continuous decline in the cost recovery ratio, and most importantly, began to make losses in its rail business in 1995. This could be explained by three factors: low prices, highly increased costs and competition from other modes. All of them mainly stem from the rigid regulatory regime and management.

2.4 Service Quality

Because of the fast-growing demand and capacity constraints, CR's management attention has focused on maximising operational efficiencies as opposed to improving customer service. CR's services are poor in quality compared with Western Europe:

- Suppressed demand . There were 20 bottlenecks on main trunk lines in 1995, with about 10% - 20% suppressed demand during the economic boom period, e.g. more than 40% of monthly wagon requests were denied in 1990.
- Longer waiting time and stringent requirements on shippers. For freight, the shipper usually must give between 18 to 48 days advance notice to order a wagon, and is permitted only some four hours to load or unload a wagon when it arrives. while for passengers, long waits (e.g. 24 hours) for rail hard bed tickets on congested railway lines are common.
- Slow travelling speed. Comparing 1995 with 1980, the travelling speed of passenger trains increased from 43.9km/h to 49km/h, the travelling speed for freight trains increased from 28.7 km/h to 30.2 km/h, only 5.1km/h and 1.5 km/h increased respectably. In Western Europe, the average speed for passenger trains on developed networks was 117.7 Km/h in 1993 (Nash, 1993).
- Low frequency. The average passenger train frequency per day of CR was 17.8 in 1995 and there were only 1-2 direct train per day from Beijing to the provincial capitals. Unsatisfied demand and overcrowding are common. While in UK , the average passenger train frequency per day was 60.7 in 1993 (the number of JR was 90.4 in 1994) and there are 17 trains from London to Edinburgh, 36 trains from London to Manchester and 15 trains from London to Paris every day.

Indeed, CR has increased its transport capacity by raising its operating efficiency at the cost of service to its customers. It is also investing heavily in new infrastructure, with over 1,000 km of new line constructed between 1990 and 1995.

2.5 Legal Constitution, Organisation and Role of Government

According to the Railway Act 1992, CR is managed by the Chinese Ministry of Railways(MOR) which has a dual role: as a government department responsible for developing and implementing railway policy once it has been adopted by the government; as a monolithic state enterprise responsible for managing the operations of the railway network while each of the 12 railway regional administrations are partially operationally and economically independent (diagram 1).

The MOR is closely controlled by the central government who exercises authority to :

(1)Direct MOR's development plans, based on the long- and medium-term development plans at the national level; and

(2)Approve a number of decisions including the following:

(a) MOR's annual targets of total traffic and total coal traffic from Shanxi;

(b) The total size of railway investment in a Five-Year Plan;

(c) Major railway capital construction and upgrading projects;

(d) Changes in railway tariffs;

(e) The total level of MOR's borrowings in each Five-Year Plan;
(f) Wage levels of railway employees; and
(g) MOR's financial statements.

(3) Other regulatory functions, such as safety and environmental protection.

So, being a government department, MOR has practically no effective control over its investment and pricing policies; being an enterprise, CR has not been given much commercial freedom, carrying on the various obligations imposed on it by the central government in pursuit of its social objectives

Since there is no competition within the railway due to its monolith organisation and only limited competition from other modes, there is little internal and external pressure for CR to improve its efficiency.

3. RECENT RAIL REFORM IN CHINA

Railway reform in China stems from the general economic reform policy, lack of network capacity and investment, low level of service, increasing competition from other modes, and loss (after tax) started from 1994. As in other countries, the major instruments of change can be summarised as decentralisation and deregulation.

3.1 Decentralisation of powers to MOR

In the past fifteen years , China has taken a number of steps to improve railway management. One of the government's important steps was to design and implementate an Economic Contract Responsibility System (ECRS) between the Central Government and MOR.

A) Separation of CR Finances from Central Government Finances-- the Economic Contract Responsibility System (ECRS) Between the Central Government and MOR .

Before 1981, MOR had no financial responsibility for operation and investment , turned over all net profits to the Government and paid a 15% sales tax on gross revenues, while the government provided all the investment funds and operational costs to MOR, i.e. "income being submitted to the Government, expenditure being covered by Government and financial results being the business of the Government. From 1981 to 1985, MOR went through a transition period where it continued to pay a business tax but only turned over part of its profits to the government. At the same time the State phased out its direct investments in favour of loans to MOR; From 1986 , a new system of "revenue, expenditure and capital investment being managed and controlled by MOR on a contract basis" was initiated, under which :

(a) MOR paid a lower business tax (down from 15.3 to 5.3% as a percentage of revenue) to the State, while the income tax and profit were kept by MOR in a railway investment fund. MOR should supplement this with loans from both domestic and international sources. The central government will not supply any funds for rail construction.

(b) Rail investment and construction. MOR was responsible for all the investment required during the contract term and should undertake not only the specific new lines and existing line construction , but also the supply of the rolling stock .

(c) Service specification. MOR undertook to secure the provision of specific passenger and freight services.
(d) Price controls. The State still controls prices, but promised to give a high priority to increasing rail prices during the contract term.
(e) Contract term. The contract lasted five years from 1986 to 1990.
(f) Incentive pay system. This system connected the total wage payment of rail staff with the traffic units that MOR carried.
(g) Existing debts were written off.

3.2 Decentralisation of Decision-making from the Ministry Headquarters to the Regional Railway Administrations(RRA).

In line with the implementation of **ECRS,** the shift of powers from Ministry headquarters to the regional administrations has occurred in the management of projects, profits and personnel, to improve productivity and accountability of the regional administrations. The main changes were:

- decentralisation of budgets for rehabilitation, upgrading, and minor construction projects to RRAs (large scale construction projects are still controlled centrally)
- retention of some profits by RRAs based on performance (previously all profits were retained by Central Government)
- some staffing and organisational decisions were now taken by RRAs

3.3 The Effects and the Problems of the ECRS

a) Effects

Table 12 presents the main performance indicators for CR during the ECRS (the seventh five-year plan) and the comparison between the ECRS and the previous five years, and the targets set by the Government.

- It may be seen that the profit generated during the ECRS is 89,9% higher than that of the previous five years and the investment, of which more than half was used for upgrading trunk lines, increased almost 50%. As a result, the capacity of the trunk line was increased by more than 20%.
- MOR carried more traffic units than before. Although the passenger trips in 1990 dropped due to a 112% increase in fare in Sep., 1989, the total traffic units carried during the contract term was 25% higher than before.
- Labour productivity in term of traffic units per staff increased 16.4%.
- Substantial growth of diversified business. In 1986, MOR began a major program to divert a portion of its transport staff to a wide variety of ventures, not only producing 630 million in revenue, but also shifting about 300,000 transport staff.

b) Problems

Several problems have been encountered in the implementation of the ECRS.

- Instability of external conditions. During 1986-1990, CR's profitability and its ability to finance capital investment was threatened by high inflation. Substantial price adjustment for steel, cement, petroleum and so on, changed the macro-environment in which CR operates and increased railway construction and operation cost dramatically, e.g. RPI of 1990 / RPI of 1985 =161.49%(table 13).
- Rail price adjustment was not given priority as the central government promised. Although the government permitted CR to raise passenger fares by 112 % in 1989, and freight tariffs by 24% in 1990, it was too late for CR to generate enough profits for investment.
- Short-sighted behaviour, such as less incentive to invest in new lines, exploitation of customers, reduction in the input to maintenance of the infrastructure at the last year of contract term (as their immediate effects are not apparent), due to short contract term and lack of supervision regime and experience. (The Chinese economy is in a transitional period from direct control to indirect regulation, esp. for CR, a traditional semi-millitary organisation.)
- It was difficult to deal with the relationship between commercial and social services and lack of competition due to MOR acting as a government agent and an enterprise as well.
- The plan target set by the government was too high to reach.
- There was no incentive scheme for the management to fulfil the contract.
- There has been no direct means available for the central government to ensure delivery of commitments by MOR.

Although the ERCS was not kept as a running contract for the next five year (1990-1995) due to the political environment and some problems which were difficult to overcome under present conditions, such as instability of external conditions, short-sighted behaviour, lack of monitoring measures and incentive scheme, it really was an important step for MOR towards the road of commercialisation.

3.4 Deregulation and Ownership

Since the implementation of the ERCS, a degree of railway deregulation has been introduced in China, particularly in the fields of the mix of ownership, price and entry control, although they are not as extensive as other modes (Taplin, J.H.E. ,1993).

(a) Joint Ventures

Lack of railway capacity and investment have been a spur to relaxing ownership control. This results in the change of corporate structure of Chinese railways.

The establishment of joint-ventures (between MOR, provincial governments and other entities) for new line construction and operation ended the central government ownership and operation of the complete national railway system and accelerated reform of CR.

For many years, development and operation of the national railway system was monopolised by MOR and highly regulated by central government. This situation was nearly unchanged

until 1987 when Guang Dong Province (GDOP) wanted to establish a co-operative venture between MOR and GDOP to finance, build and operate San-Mao Railway (SMR), a 357 KM rail line connecting the west part of GDOP to its capital. This suggestion was finally approved by the State Planning Commission (SPC) in 1987. SMR was built by 1990 with a lower cost and time than planned. Simultaneously, more than ten provinces either began their rail construction or showed strong interest in this field.

There are a number of reasons for this development:

- **Growing shortage of funds with the central government** There was not enough money for MOR to invest in new line construction, esp. for those which have little benefit for the whole network;
- **Growing shortfall in provincial rail construction**, which was urgently needed for the regional, provincial , or local socio-economic development;
- **Changing economic environment**. Decentralisation, esp, a degree of separation of provincial budgets from Central Government makes local government have more autonomy in investment;.
- **An increasing joint-venture experience in other utility industries in China**, such as other transport modes, electricity and telecommunication;
- **Success of international experience in railway deregulation.**

The following were seen as the main benefits:

- Leveraged development. Typically, the national railway companies only use equity to build the new rail lines, while the joint ventures use a hybrid capital structure and can often draw on a wide range of capital sources, such as equity and quasi-equity from the governments and non railway companies, loans from the banks and issuing bonds, although the capital structures of the joint ventures vary from project to project. Statistics (Wu, J.H., 1994) showed that among the 17 joint ventures established before 1996, the mean equity/debt ratio was 7:3, of which more than 60% of the equity came from non central government sources. That is to say, central government uses one part of money to attract more than three parts of investment from other sources.

- Efficient construction and operation. The joint ventures can build the new rail lines more rapidly and efficiently: not only due to the involvement of the local governments which provided most favourite conditions, especially in the fields of requisitioning urban and rural land, manpower and local construction material; but also they are more commercially oriented, trying to reduce the construction cost as far as possible. Table 14(Wu, J.H., 1994) shows the different construction efficiency between the joint ventures (taking the five large joint ventures for example) and the national railways.

  The joint ventures are also able to apply operating flexibility(by adopting more market oriented pricing regimes, developing innovative revenue sources, such as real estate development, tourism) to increase operational efficiency.

- Risk allocation. The joint ventures can transfer risk to the local governments, non rail sectors and even private companies that would otherwise be borne by the central government .

- Creation of (route, yardstick) competition. The route competition will mainly come from

the joint ventures whose line are parallel with that of the national railways or even shorter, such as San-Mao, Ji-Tong, He-Jiu and Heng-Nan.

A State Council's Statute, "Policies for Encouraging Non-central Government Funds to Build and Operate Railways", was issued in 1992. Its main contents were:

- Clarification of the relationships between investment, ownership and rewards.
- Establishing a co-operative venture and running railways as a business.
- Clearly defining the responsibilities, rewards and risks between partners.
- Relaxing tariff control.
- Reducing tax level.
- Availability of loans on favourable terms.
- A certain degree of open access.
- Permitting railway diversification, such as commercial use of land, tourism, etc.

This was a clear evidence that more than forty year of CR's complete central government ownership and operation has ended. Political pressure to restrict entry has consequently been limited and has been outweighed by the objective of attracting investment from non central government sources.

By the end of 1995, 22 joint-venture railways were established, spreading over 18 provinces and autonomous regions with total length of 7933 KM. The total planned investment was 35 billion Yuan, while more than 42% of the investment came from non-central government agencies including provincial governments, publicly owned companies, private sector and even foreign investors. The Hong Kong United Company Limited joined with MOR and Zhejiang province, and invested US$ 1.7 million in the construction of Jinhua to Wenzhou(250 km).

(b) Other Deregulation in Ownership

Stocks are being issued, on a trial basis, with a view to changing the traditional rail enterprises into a modern company and raising funds at same time. For instance, changing Guang-Shen Railway Company into a PLC by selling some of its shares (30%) in the Hong Kong Stock Market to raise 5billion HK$ in 1996. At the same time, a 30% share of Sanmao Railway company was sold in the domestic Stock Market to change its unreasonable capital and debt ratio.

Attracting investments from provincial governments and other entities for upgrading existing lines is underway. The success of establishment of joint-ventures for new line construction encourages MOR to extend this system for existing line upgrading. A feasibility study on establishing a joint-venture between MOR and Zhejiang Province to build a double line from Ningbo to Xiaoshan (more than 200 km) was carrying on in 1996.

Guangzhou Regional Railway Administration was changed into a railway Corporation (Group) in 1993 (from a cost center into a profit center) and Dalian Sub-regional Railway Administration into a railway Limited Corporation in 1995.

3.5 Price Deregulation

Facing the fact that the basic fare of CR is tightly controlled by the central government, CR are trying to adopt a so called "peripheral breakthrough strategy" to let the price regime approach the market as far as possible. Some fares are allowed to be differentiated by the quality of service provided, by the companies which have different ownership , and even by the time of the year to adapt to different demands and maximum the revenue.

(a) National Railway-- Multi-tier System

- "New Service , New Price" . Premium services are allowed to charge premium prices. e.g. special express trains and tourism trains with air-conditioning are allowed to increase their price up to 60% above that of normal. As a result, MOR run 43.5 special express trains (23% of the total special express trains running through more than one RRA) and 48.5 tourism train (17.% of the total express train running within a RRA) per day in 1995;
- "New Line , New Price". Newly constructed lines are allowed to set higher tariffs up to half the road price as a way to recover their investment cost, esp. for returning the debt. e.g. Daton-Qinhuandao heavy haul line can charge 180% higher than the uniform fare, while the same plan for newly constructed lines, such as Lan-Xin, Bao-Zhong, Hou-Yue, and Jing-Jiu, is under consideration;
- 7 of the 12 RRAs can charge substantial premiums with no more than 30% above the normal fare at peak times (Chinese New Year) from 1995.
- Freight rates are usually not differentiated , but some tests on "negotiated" prices between railways and shippers have been carried out: If the railway achieves the planned target set by the government, it can sell its extra capacity at "negotiated" prices, on the principle of the willingness to pay, to the shippers.

(b) Joint--ventures: New Ownership , New Pricing Regime.
The Joint--ventures are allowed to set their tariffs according to the competition from road and the need to recover their investment cost and make a reasonable profit. In addition, the price can be floated up and down within 30%--50% according to the market conditions without authority.

3.6 Open Access and Competition

The Joint--ventures and local rail companies are allowed to operate some passenger and freight services on the national railway network according to availability of line capacity. For example, Sanmao Railway Corporation Limited are running at least 4 trains per day on national railway network (from Maoming to Guangzhou, from Zhaoqing to Shenzhen via Guangzhou, and from Guangzhou to Zhanjiang via Maoming). Another example is the Baoshen Railway Corporation, which running 2 coal trains per day from Shenmu (a coal mine in Shanxi Province) to Qinhuangdao (a seaport in Hebei Province) on CR's track.

So far, open access has had little adverse effect on the incumbent operators because there is enough business for everyone; in addition, some national railway companies can even benefit from the access charge and increase in traffic generated by the new entry. In case of congestion, some RRAs are unwilling to allocate scare slots to joint-ventures, but sometimes they have to according to the State Council's Statute mentioned above. Last, but not least,

effects may also come from yardstick competition. It is obvious that the joint-ventures are more commercially oriented than national companies due to the stronger pressure from the creditors and road competition, and a stronger incentive structure for the managers. For example, they established their organisation in the line of business (each of them has marketing/sales business unit), instead of the traditional functional unit adopted by national railways.

3.7 Railway Diversification

Non-railway activities were strictly controlled by the central government before the implementation of ECRS. To generate more profit and then cover the "loss-making" on railway business, CR and government agreed that the railway should diversify its activities. Unlike the case in most developed countries, CR's railway diversification developed dramatically and has played a very important role in terms of revenue and profit.

In 1995 the total income from diversification was 29.7 bn Yuan, almost half of the total rail business income, while in 1985 it was 0.63bn Yuan, only 3% of the total rail business income. During this time, the total income of the diversification increased more than 45 times.

Type of Diversified Businesses include: freight forwarding, warehousing, commerce and trade, overseas shipping, container shipping, food and beverage service, travel, advertising, real estate, mining, building construction materials, international trade, etc. (Li, H. , 1997).

But people, especially small retailers and small shippers, were often hostile to this policy and complained that some of the diversification revenue came from the abuse of the railway's monopoly power, for example, small shippers have to pay 2-5 times higher than normal price if they want to get scare capacity. Moreover, it is said that diversified business supplied a good chance for corruption.

3.8 Others e.g. Rationalisation of Branch Lines

There were 150 branch lines with total length of 7000 km in CR, of which 80% lose money with a total amount of RMB 430 million in 1989. Several methods were used to improve their efficiency.

- improving operational efficiency by reducing work force, closing some small stations;
- co-operation with local government to establish a local rail company, to raise the price up to 1/3 or 1/2 of the road, to collect surcharge for rail upgrading;
- diversifying rail business;
- line closure when possible;

4. CR'S REFORM IN THE FUTURE

4.1 What can we learn from international railway reform?

Before embarking on a full discussion on CR's need and the form of reform, it is worthwhile to summarised the lessons for CR from the railway reform models found elsewhere in the world. These fall into three main types:

(a) Outright Privatisation as an integrated deregulated railway

This has been the approach in the United States where most railways have remained in private hands, and the principal reform has been the removal of most controls on charges and services, as well as in New Zealand. It is also basically the approach adopted in a number of South American countries (Brazil, Argentina, Mexico) although there privatisation has taken the form of very long (30 years or more) franchises rather than outright sale. All the above railways are dominated by freight traffic; in some cases there are limited passenger operations provided by third parties. The situation is the reverse in Japan, where integrated regional passenger companies are being privatised; the limited amount of freight is operated by a separate company. The advantage of this approach is the commercial freedom and incentives to efficiency it gives the privatised companies. But its effectiveness depends on intense competition from other modes.

It is hardly thinkable that this approach could be adopted in China. The rail system remains so dominant a mode of transport that close government control or regulation is clearly needed, and it is very doubtfiul whether outright privatisation would be politically or financially feasible.

In all the above cases, except for the small system of New Zealand, there are integrated regional companies. Regional separation certainly appears an option worth considering further for China given that it is already organised into RRAs.

(b) Separation of infrastructure from operations

This is a key feature of European rail policy, but it is also being followed in some other countries (e.g. Australia). Its key advantage is that it permits a number of competing operators to share the same track without anyone of them having control over it. The competitors may be actually competing on the track, or simply for the franchise to run particular services. The latter approach has been taken furthest in Great Britain where all passenger services have been franchised out.

The key advantage of this approach is the introduction of competition within the rail sector; this may be particularly important where rail has strong monopoly power, or where a single operator will be subsidised.

(c) Sectorisation

This is the process of dividing the railway into clearly defined market segments, each with a considerable degree of autonomy in terms of management and with its own objectives and accounts. Typically the sectors will cover long distance passenger, regional passenger, suburban passenger, bulk freight and intermodal freight. The process was probably taken furthest in British Rail prior to privatisation, but has been followed to some extent by other

European railways such as Germany, France and Spain. It has generally been followed by improved performance, resulting from enhanced clarity of objectives and incentives and management of units of a more appropriate size.

4.2 Options for CR's Reform

4.2.1 Does Ownership Matter? The ownership options for CR's Reform

In theory, it is concluded that the allocation of property rights does matter because it determines the objectives of the "owners" of the firm (public or private) and the systems of monitoring managerial performance. Public and private ownership differ in both respects. As a result, changes in property rights will materially affect the incentive structures and hence the behaviour of managements (Vickers, J. and Yarrow, G. , 1988). It is often argued that it is competitive, privately-owned firms which have incentives to achieve both productive and allocative efficiency, but it looks as if there is a far less clear-cut picture in practice (Table 15).

There are several ownership options for CR:

(a) Public owned--Central government owned only, mix of Central government, Provincial government and local government;

(b) Mix of Public- Private Ownership(Partnership);

(c) Private owned only.

As we have stated above, it seems most unlikely that Chinese Railways would be privatised outright; even if it were there would still be a need for tight regulation. However, the prospect for partnerships between the public and private sectors, as well as between central and local government, appear good. The main reason is the acute shortage of investment funds referred to above.

4.2.2 What's the Role of Competition in CR's Future Reform?

a) The Role of Competition

"Increasing competition is the most important mechanism for stimulating improved performance and one which may be more effective than changing ownership" (John Kay etc., 1986). "Where a public enterprise operates in a highly protected or regulated environment, deregulation may generate a substantial improvement in public-sector performance, without ownership transfer" (Domberger, S. and Piggott, J. 1994). The practice of joint-ventures shows that in a growing industry competition has little adverse effect on the incumbent operators.

b) Contestability and Barriers to Entry (Constraints on Competition)

There appear to be several barriers to entry: sunk cost, capacity constraints, regulation regime, charging regimes, management skills, technical barriers, safety regimes and acquiring locomotives and crew, of which congestion, regulation regime and charging regimes are most

important.

Take the regulation regime barrier for example, newly established joint ventures often complain that they are discriminated by RRAs or SRRAs in the fields of slot allocation, rolling stock purchase and repair price, higher rail price, and much longer wagon turn-around time. The RRAs argued that the prices that joint venture required are internal prices within the national railways and the joint ventures should pay the external prices in market economy. These problems mainly root from the two-fold position of MOR. As a government department, MOR should work as a neutral organisation available to all operators and responsible for fair competition. As an enterprise, MOR should help his RRA to compete with the joint ventures to retain its interest. The joint ventures face the risk of anti-competitive behaviour where the network operator also competes in downstream markets.

c) Options for Competition

Several option for competition are listed as follows:

- Open Access
- Route Competition
- On Track Competition
- Franchise Competition
- "Yardstick Competition"
- Competition for Rolling Stock Investment , Production and Leasing
- Competition for infrastructure Investment, Construction and Maintenance

Some of them which have been carried out on a trial basis , such as open access , competition for rolling stock production, for infrastructure design, construction and maintenance, should be extended as far as possible with some necessary modifications. Some of them could be carried out on a trial basis, such as franchise competition, competition for rolling stock leasing, "Yardstick Competition", competition for infrastructure investment and route competition. However, whether on track competition is suitable for CR is an issue related to separation of infrastructure from operations which will be discussed later.

4.2.3 Should Chinese Railways be split up?

Three questions should be answered on this issue (a) Split or not? if yes, (b) What are the alternative ways of doing it? and (c) which should be selected?

(a) Split or not?

According to Foster C.D. (1992), ' it has been argued that all monopolies can be broken up into smaller businesses, it does not follow that the outcome will be greater efficiency or even more competition'. There is a trade-off between break-up and economies of scale. However, what evidence there is from North America and Europe suggests that there are no efficiency advantages and probably considerable costs from having very large railway organisations.

(b) Reorganisation options . Regions , Sectorisation or Vertical Separation?

(i) Regional

One obvious way to divide the railway into smaller units is on a regional basis. This was the approach adopted in Japan, where most of the railways are on different islands, and even

where there are three companies on the main island, more than 90% of traffic is internal to one company, so the problem of through traffic between them is very small. In the case of China this is a much bigger problem. It would be ideal from the point of view of minimising disruption if the new regional companies were established based on the existing 12 RRAs or on the Provinces, however, a simple demand analysis suggested that rigid over-reliance on the current RRA or Province boundaries as the basis for the new organisation boundaries could be risky because the traffic flows do not correspond to Administration boundaries. 60% of freight ton-km was inter-provincial in 1993, while inter-RRA passenger traffic flow was 60.4% in 1995 in term of passenger km. That is to say there will be around 60% of the traffic volume which must cross at least one Administration boundary where it is exposed to all of the problems of co-ordination, interchange slippage, revenue allocation and lack of integrated marketing and pricing that will cause lower level of service and less competitive compared with the road.

Another factor to determine the company boundary is the cost. Optimal industry organisation is also constrained by cost structures. According to Preston (1994) , to minimise operating costs , the optimal railway firm should have a network of around 4000 Km , optimal train Km of around 120 million per year and hence an optimal density of around 30,000 train Km per line per year. A comparison between the optimal size of EU railways and the current 12 RRAs of CR shows that (table 16): (a) In terms of output per year in term of million train km, 8 are greater than 220, 10 greater than 120, only 2 smaller than 120; (b) In route-km, 6 larger than 5500 km, 6 smaller than 4000 km; (c) density per line km, 9 larger than 40000, all larger than 30000.

The key point here is whether the conclusion got from the EU railways can be transferred to CR, a railway which has different characteristics from that of EU.

(ii) Sector

According to Thompson, L. (1996), 'LOB organisations are a first step because they give railway management(and government) an initial ability to define markets and evaluate the related products, costs and revenues'. Sector managers can be given clear objectives and incentives, and operations may be more manageable in size and less diverse. A form of sectorisation would appear to be very appropriate for China, although the intense use of the same infrastructure means that the sectors will inevitably remain closely interdependent.

(iii) Vertical separation

Separation of infrastructure from operations will become more difficult due to lack of capacity. At present, some 94% of the railway is operating at or near capacity and there were 20 bottlenecks on main trunk lines in 1995, with about 10% - 20% suppressed demand during the economic boom period. This is far more serious a problem than any bottlenecks that may exist in Europe. On the other hand it is far more like the case in Japan. (ECMT Round Table 103, 1997). There is little scope for supplying paths to new operators, whilst the efficient use of existing paths is a key consideration. This does not means that some operations could not be franchised out to separate operators, or that a degree of open access - for instance for freight customers to run their own trains - could not be provided.

According to Suga, T., of JR East (Nash, C. A. 1996), 'Japan is a very, very over-populated

country and our infrastructure is fairly poor if we consider the enormous amount which we carry on our railways. So the **Japanese railway infrastructure is very, very heavily used** compared with European railways and under such environments **it will be very, very difficult to separate infrastructure and operation.** It does not lead to the best use of infrastructure'. Table 17 shows that the average gross ton-km per route km of CR is seven times greater than that of BR and even 2 times greater than that of JR. For main trunk, trains density (trains per day per route km) is 75% greater than that of BR and almost as same as Shinkansen of JR. If the conclusion from Mr Suga is right, what will it mean to CR? (These mean more maintenance work and more tight relationship between infrastructure and operation. The quality of infrastructure of CR is much poorer compared with that of JR and Western European Railways).

Investment planning is also a difficult issue in a separated railway. By the end of 1999, CR's route km will increase to 68,000 Km with 34% of double-track route and 27% of electrified route. That is, from 1995 to 2000, there are at least 2974 Km of existing lines undergoing upgrading (1242 Km double track and 1732 Km electrified) per year. During this process, there must be a lot of co-ordination work between infrastructure and operations. Appropriate charging regimes for rail infrastructure also remain an unsolved problem.

Other problems such as safety, integrated information, ticketing and seamless transport, are all very difficult issues for CR if the separation is implemented, to say nothing about transaction cost.
It is probable that in many instances the additional complexities of operation would negate the increased efficiency achieved by competition resulting from separation(Kay, J. etc. Ed , 1986). This may be the case for CR if the vertical separation option is adopted.

(c) Which option to select

It appears from the above that none of the models found abroad is readily applicable to China. However, elements of all of them may make sense. For instance, a basic sectoral organisation, combined with regionalisation of short distance passenger services, franchising of non-core activities and a greater degree of open access may make sense. But experience suggests that reform of the relationship between CR and the government may be a more urgent development in order to improve CRs performance. We comment briefly on this issue before reaching our conclusions.

4.2.4 Regulatory Regime. The Relationship between Government and Railway

The establishment of a healthy regulatory framework is vital to the creation of a good and fair competitive environment for the railway industry. According to the degree of the management independence in terms of entry and price control , the relationship between national railways and government can be classified as in Table 18 (Nash, 1997).

Regulation is viewed in modern economic theory as a game between the policy agency and the firm(s), and the focus is on the incentive properties of various regulatory mechanisms to encourage both internal and allocative efficiency (Vickers, J. and Yarrow, G. , 1988). Oum and Yu (1991), suggested that if railways are provided as a direct government agency, they will be 11% less efficient and if they are provided as a quasi-public corporation (such as

Amtrack), they will be 20% more efficient than as a state owned enterprise. Managerial autonomy explained one third of variation in technical efficiency between European Railways. It is obvious that improved efficiency can be achieved even if CR is only changed from a government department to a state owned enterprise.

Clarifying the distinction between Commercial Business and Public Service Obligations (PSOs) is the first step, but unfortunately, little has been done in China in the fields of identifying for social obligations, to say nothing about compensation. In India(Indian Railways , Year Book 1994-1995), although the social costs are not compensated by the central or local governments, Indian Railways have identified the costs and taken cognisance of the costs while assessing the Railways' financial performance since 1975. In developed countries, the Railways are compensated for their PSO for operating uneconomic services, complying with price restraint orders, carrying traffic at concessional rates, etc. PSO are subsidised by Government (taxpayers pay), while in China where governments usually have strictly budget constraints, it may be more practical to pay the PSO through cross-subsidy, i.e. user pays, but this may make railways less competitive than road in the long run.

5. SOME TENTATIVE CONCLUSIONS

Central to successful reform and restructuring of CR is a comprehensive planning process. However, it is obvious that a long-term solution is unlikely to be found without restructuring the relationship between the Government and CR. The major steps of this process are the following:

Stage One : Separate railway from government department to state enterprise; converting CR from a departmental undertaking into a public corporation with statutes giving much more commercial freedom.

a) Establishing a Ministry of Transport (MOT) responsible for promoting, financing and regulating the railways and the other transport modes and abolishing MOR and MOC (Ministry of Communications) and CAA (Civil Aviation Agency) at the same time. The government acts as (1) owner of CR; (2) a regulator as for the legal framework of CR's operation, monitoring capacity allocation as well as safety and environment aspects; (3) a policy setter and economic and social planner; and (4) a buyer of public services.

In line with these functions, the Government would be responsible for (i) financing construction of new strategy railway infrastructure from the Government Budget, carrying out tenders for franchising some services and concluding such contracts (as owner); (ii) setting official tariffs for domestic passenger and freight services(leave a certain degree of freedom to railways companies). Monitoring scare capacity allocation and open access, safety control and other regulatory tasks (as a regulator); (iii) the approval of CR's development concepts and monitoring its implementation(as a strategic planner); (iv) paying subsidy as a buyer of public services.

b)Establishing Chinese Railway General Company(CRGC), as an integrated State enterprise with statutes giving commercial freedom. Creation of Business Units for long distance passenger, regional passenger freight and infrastructure, identifying and compensating for social obligations.

Stage Two: Restructure CRGC into a publicly owned joint stock company probably based on Sectors (LOBs).

Stage Three: Change CRGC into a mix of private and public owned joint stock companies with its equity capital open for private sector participation, e.g. from 10-30% to 49% or even greater if the structure of ownership is diversified enough to still leave the control of the Railway with the Central Government, or if it is not necessary to keep the companies under the governmental control given continued regulatory powers.

Other Important Conclusions:

- Ownership should be open for non central government, private sector and foreign investors to form a mix of public and private ownership structure, but ownership will be still dominated by the public sector in the foreseeable future;
- Competition will play an important role in the CR's Reform with a certain degree of open access, franchising some specific freight and passenger services (e.g. branch line operation, commuter), Competition for Rolling Stock Investment, Production and

Leasing, Competition for infrastructure construction and maintenance, and yardstick competition.

- Separating infrastructure from operation completely is not feasible for CR at present, but separate enterprises providing rail services using infrastructure owned by another enterprise and which build rail infrastructure for the purpose of transferring the ownership or renting it will emerge in the future.
- Developing public and private partnerships in the field of financing, construction, ownership and operation, esp. for new products, such as high speed railway and intermodal.

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Table 1: Railway Scale, Traffic and Density

	CR(95)	IR(94)	BR(94)	USA: Freight(95)	JR(94)
Route-Km	**54,616**	62,461	16,536	174,619	20,255
Double track Route %	**31.0**	24.1	70.1		40.6
% of Route Electrified	**17.8**	18.3	30.7		58.6
Tonnes (million)	**1,593**	358.7	97	2,106.9	54
Tonne-kms (million)	**1,283,600**	252,411	12,292	1,911,023	24,100
Market Share of Freight (%)	**54**	40 (1992)	6	37(1992)	4.5
Pass. (million)	**1,021**	3,915	702		8,813
Pass. km (million)	**354,300**	319,365	28,656		244,375
Market Share of Pass. (%)	**39**	32(1992)	5		29
freight % of traffic units	**78**	44	30	98	9
Traffic units per Line km (million)	**30**	9	2.5	11	13
Route-km per 1000 sq. km	**5.69**	19.00	67.61	20.24	53.59
Route-km per mil.population	**50**	69	286	761	162
No. of Staff	**3,372,000**	1,623,158	106,748	188,215	193,145

Main sources: 1. European Railway Comparisons, Final Report, Institute for Transport Studies Working Paper 418; 2. Railway Gazette Railway Business Report 1997, Database. 3. Chinese Railway's Annual Statistics 1995.

Notes: Traffic units = passenger km plus freight tonne km CR = Chinese Railways, IR = Indian Railways, BR = British Railways, USA: Freight = US Class 1 freight railroads. JR = Japanese Railways.

Table 2: China National and Provincal Capitals

City	Population (including counties) (1993) (m.)	Nearest to	
		City	Rail distance (km)
Beijing	10.51	Tianjin	137
Tianjin	8.88	Beijing	137
Shijiazhuang	8.27	Taiyuan	231
Taiyuan	2.71	Shijiazhuang	231
Hohhot	1.42	Beijing	667
Shengyang	6.58	Changchun	305
Changchun	6.51	Harbin	242
Harbin	5.30	Changchun	242
Shanghai	12.95	Hangzhou	201
Nanjing	5.15	Shanghai	303
Hangzhou	5.87	Shanghai	201
Hefei	3.97	Nanjing	312
Fuzhou	5.51	Nanchang	622
Nanchang	3.83	Hangzhou	636
Jinan	5.34	Tianjin	360
Zhengzhou	5.68	Shijiazhuang	412
Wuhan	6.92	Nanchang	365
Changsha	5.55	Wuhan	358
Guangzhou	6.24	Changsha	706
Nanning	2.65	Guiyang	865
Haikou	0.43		
Chengdu	9.47	Chongqing	504
Guiyang	1.60	Chongqing	463
Kunming	3.67	Guiyang	639
Lhasa			
Xian	6.31	Zhengzhou	511
Lanzhou	2.61	Xining	216
Xining	1.06	Lanzhou	216
Yinchuan	0.86	Lanzhou	468
Urumqi	1.38	Lanzhou	1892
Dalian	5.27	Shenyang	397
Qingdao	6.75	Jinan	393
Shengzhen	0.88	Guangzhou	146
Chongqing	15.04	Guiyang	463
Total population(34 cities)	175.17		
Population of China	1,180.00		

Main sources: 1. Statistical Yearbook of China ,1993; 2. Chinese Railways Timetable, 1997-1998.

Table 3: Utilisation of Locomotive Kilometers per annum

	Diesel loco km /Diesel loco		Electric Loco. km/ Electric Loco.	
	1980	**1990**	**1980**	**1990**
CR	106849	119640 (94)	59233	125636 (94)
IR				
BR		69571		164483
RENFE		61378		115452
SNCF		18075		120608

Main source: 1. European Railway Comparisons, Final Report, Institute for Transport Studies Working Paper 418; 2. Chinese Railways's Annual Statistics 1980-1995.

Table 4: Distribution of Traffic by Market Sector (%)

	Passenger km			Freight tonnes kms			
	Commuter	**Inter-City**	**Other**	**Bulk**	**Inc. Coal**	**Other**	**Inc. Container**
CR (94)	0.8	60.3*	38.9	73.1	42.3	26.9	1.41**
IR (94)	21.3	78.7		95.5		4.5	
BR	45	38	17	76	22.0	24	19***
SJ				22		68	
RENFE	30	54	16	34		66	
SNCF	14	75	11	38		62	

* For CR, Inter-City: Inter-Regional Railway Administration; * * By ton lifted in 1995; ***Intermodal traffic in 1996

Main sources: 1. European Railway Comparisons, Final Report, Institute for Transport Studies Working Paper 418; 2. Chinese Railways's Annual Statistics 1994.

Notes:

SJ = Swedish Railways
RENFE = Spanish Railways
SNCF = French Railways

Table 5: Traffic Characteristics and Density

	Passenger Mean Journey Length (km)	Mean Train Load (pass)	Freight Mean Shipment Length (km)	Mean Train Load (tonnes)	TU per route km (million)	Train km per route km
CR (95)	**347**	**998**	**806**	**1634**	**30**	**20456**
IR (94)	79.9	809	703.6	1158	8.93	12306
BR	41.0	89.0	128.3	343.2	3.01	26055
DB	41.8	107.8	221.8	305.9	3.12	22405
SJ	78.5	103.4	349.5	471.0	2.53	9225
SNCF	76.4	200.2	358.7	303.7	3.30	14313

Main sources: 1. European Railway Comparisons, Final Report, Institute for Transport Studies Working Paper 418; 2. Chinese Railways's Annual Statistics 1995; 3. Indian Railways Year Book 1994-95.

Table 6: Train Kilometers and TU per Staff

	Train Km per Staff (total)		Traffic Units per Staff (000's)	
	1977	**1990**	**1980**	**1995**
CR	427 (80)	496	462	824
IR	313 (80)	369	197	355.1 (94)
US: Class I Rlys		3389 (93)		10153
BR	2417	3193	263.0	453
DB	1750	2559		
SJ/BV	2830	3501		1118(94)
SNCF	2096	2413		
MEAN of WE	2302	2926		

Main source: As Table 1; 2. Railway Business Report 1998, Database; 3. UIC Statistics 1993.

Table 7: Traffic Units/Train Km

	Total		Passenger	Freight and Parcels
	1980	**1990**		
CR	1064	1453 (95)	998 (95)	1634 (95)
IR	629	900 (94)		
BR	120	113.97	88.97	341.17
RENFE	180	170.64	128.80	285.37
SJ	230	249.23	103.42	471.01
SNCF	250	234.66	200.25	303.68

Main source: Same as table 6.

Table 8: Receipts/Traffic Units (pence)

	Total	Passenger	Freight
	1990	1990	1990
CR	0.29 (95)	0.42(95)	0.22(95)
IR	0.62 (94)	0.30 (94)	0.95 (94)
BR	5.77	6.21	4.15
DB	4.28		
SJ	2.24	5.17	1.23
SNCF	3.38		

Main source: 1.Same as table 6; 2. Indian Railways Year Book 1994-95; 3. £1=RMB 13.0 .

Table 9: Breakdown of Total Cost (%) (1990 except where shown)

	Staff		Supplies and Service		Depreciation Historic cost	Interest
			Fuel	Other		
	1980	1990				
CR	16.8	21.8(95)	20.8	25.4	32.0	
IR	51.1	48.3(94)				
BR	60.0	59.1	5.0		4.5	1.1
DB	68.0	60.7	5.1	12.7	6.3	9.8
SJ	69.0	45.1	4.7	32.6	14.7	2.8
SNCF	60.0	48.9	2.7	20.3	7.4	14.8

Main source: Same as table 6.

Table 10: Financial Indices

	Staff Nos/Staff Costs (£m)		Receipts /Total Costs			
			Rail business only		Rail and non-Rail business	Rail business with the construction surcharge imposed on freight
	1980	**1990**	**1977**	**1990**		
CR	13500	1428(95)	1.62	0.99(95)	1.03	1.45
IR	6800	1120(94)	1.04	1.20(94)		
BR	75	66.4	0.71	0.82	0.85	
DB	58	38	0.61	0.44	0.58	
SJ/BV	52	67.4	0.83	0.59	0.73	
Mean:			0.59	0.46	0.63	

Main source: Same as table 6.

Table 11: Financial Indices

	Staff Costs/Operating Costs (£m)	Receipts / Operation Costs Rail business only		Rail and non-Rail business
		1980	**1990**	**1990**
CR (93)	0.29	3.10	1.67	
IR				
BR	0.63	0.68	0.87	0.90
DB	0.75	0.58	0.52	0.69
SJ/BV	0.55	0.80	0.72	0.88
SNCF	0.63	0.60	0.64	0.87

Main source: Same as table 6.

Table 12: CR Performance During the ECRS (A comparison from Sixth Five-Year Plan (1981-85) to Seventh Five-Year Plan(1986-90))

	Planned (1986-1990 or 1990 only) (1)	Completed (1986-1990 or 1990 only) (2)	Completed (1981-1985 or 1985 only) (3)	(2)/(1) %	(2)/(3) %
Freight Lifted (m ton)	1600*	1462*	1275**	91.38	114.67
Passenger Trip(m)	1400*	949*	1109**	67.00	85.57
TU(billion ctkm)	1399.7*	1321.0*	1052**	94.37	125.57
Rail Income (billion. RMB)		150.96	76.65		196.9
Rail Costs (billion. RMB)		96.51	42.44		227.4
Profit (billion. RMB)		38.72	20.39		189.9
Investment (billion. RMB)	45.27	49.35	33.58	109.02	146.97
New Line Construction(km)	3600	1682.1	1496.4	46.72	112.4
Double Track(km)	3300	2416.1	1607.5	73.23	150.3
Electrified(km)	4000	2764.2	2505.6	69.11	110.3
Rolling Stock(m.RMB)		17,748	4,357		407.3
Investment in Rolling Stock Production(m.RMB)		39.14	11.7		334
Labour Productivity (TU/Staff) (000)		673	578		116.4
Railway Diversification					
Income (billion. RMB)		6.28	0.63		996.8
Profit (billion. RMB)		1.29	0.17		758.8

* Year of 1990 only; ** Year of 1985 only.
Main sources: 1.Chinese Railways Annual Statistics 1980-1990.

Table 13: Retail Price Index of China (1980-1995)
(1950 = 100)

Year	Retail Price Index
1980	146.9
1985	174.1
1990	282.2
1991	290.4
1992	306.1
1993	340.5
1994	414.4
1995	476.5
Average annual growth rate	8.16

Main source: People's Republic of China Year Book, 1995/1996.

Table 14:Construction time and cost comparison between the joint ventures and national railways

Joint Venture	Length (Km)	Construction Time for 100 km rail line (year)	Construction Cost (million RMB/ Km)
San-Mao	357	1.3	4.8
Beijiang	460	1.1	1.6
He-Jiu	305	1.3	4.5
Ji-Tong	943.3	0.5	2.3
Guang-Mei-Shan	480	0.8	7.2
The counterparts built by national railways		46% of them was more than 5 years.	Most of them were over 5.0

Main source: WU, J.H. (1994) "Policies for the Development of Joint-Venture Railways",Reference for Economics Research,Vol.194,1994.

Table 15: Ownership, Competition, and Efficiency Incentives

Can the firm go bankrupt? Can it be taken over? Is the product market competitive? Incentives to-- allocative efficiency? --productive efficiency?	No No No No No	No No Yes Yes No	Yes Yes No No No	Yes Yes No No Yes	Yes Yes Yes Yes Yes
Kind of firm	Public owned monopoly	Public owned competitor	Large private monopoly (national or regional)	Smaller private monopoly	Competitive private firm
Example of firm	CR, IR	Some rail joint-ventures in China, CN in the past	US freight companies, Railtrack, JR passenger companies	New Zealand, JR freight EWS Railway	BR passenger TOC

Main source: Adapted from John Kay, Colin Mayer and David Thompon, 1986 (Ed), *Privatisation and Regulation--the UK Experience.*

Table 16: Optimal size---European and CR's 12 RRAs

CR's present 12 RRAs	Output per annum (train km)	Route-km	Density per line km	Optimal size with capital cost fixed	Optimal size to minimise operating cost
Hairbin	245	6735.8	36377		
Shenyang	536	8810.9	60840	220 million train km,	120 million train km,
Beijing	647	6861.6	94301	5500 km and 40000	4000 km and 30000
Huhehaote	55	1617.9	34013	train km per annum	train km per annum
Zhengzhou	737	6226.3	118374		
Jinan	281	2484.4	113123		
Shanghai	683	5844.4	116872		
Guangzhou	503	3021	166501		
Liuzhou	132	1893.2	69730		
Chengdu	301	5688.9			
Lanzhou	137	3853.8	35556		
Wulumuqi	70	1578.1	44359		

Main source: 1.J. Preston (1993). *Does size matter? A case study of Western European railways. 2. Chinese Railways' Annual Statistics, 1995*

Table 17: Train Characteristics, Density and Its Distribution

		Trains per day per route km	Mean train Load (pax)	Mean train Load (tons)	Traffic unit per route km (million)	Gross ton-km per route km (million)
	Main trunk line	**188.0**			**95.6**	**137.0**
CR	**Trunk line**	**125.0**			**63.4**	**90.9**
(93)	**Mean**	**56.0**	**998**	**1634**	**30.0**	**43.0**
IR	Mean	34.0	809	1158	8.9	19.6
	Intercity	**26.0**				
BR	**NSE**	**97.0**				
(92)	**Regional**	**45.0**				
	Mean	**71.3**	**89.0**	**343.2**	**3.01**	**5.19**
DB	Mean	61.0	107.8	305.9	3.12	7.95
SJ	Mean	25.3	103.4	471.0	2.53	
JR	**Shinkansen**	**147.4**				
	Mean	**104.9**			**13.25**	**14.38**

Main source: 1. UIC International Railway Statistics, 1994; 2. *Chinese Railways' Annual Statistics, 1995*

Table 18: The Relationship between Government and Railway

Private owned joint stock companies	UK Railtrack, UK Freight, USA and Canada Freight, New Zealand Freight, Argentina Freight Operation
A mix of private and public owned joint stock companies	JR
Publicly owned joint stock companies	Germany, Sweden, Italy
State enterprise with statutes giving commercial freedom	SNCF, Most of the Central and East EU Railways
State enterprise with statutes not giving much commercial freedom	Some of the Central and East EU Railways
Government department	CR, Indian Railways, RZD

Diagram 1 The Role of Government and the Organisation Charts of CR

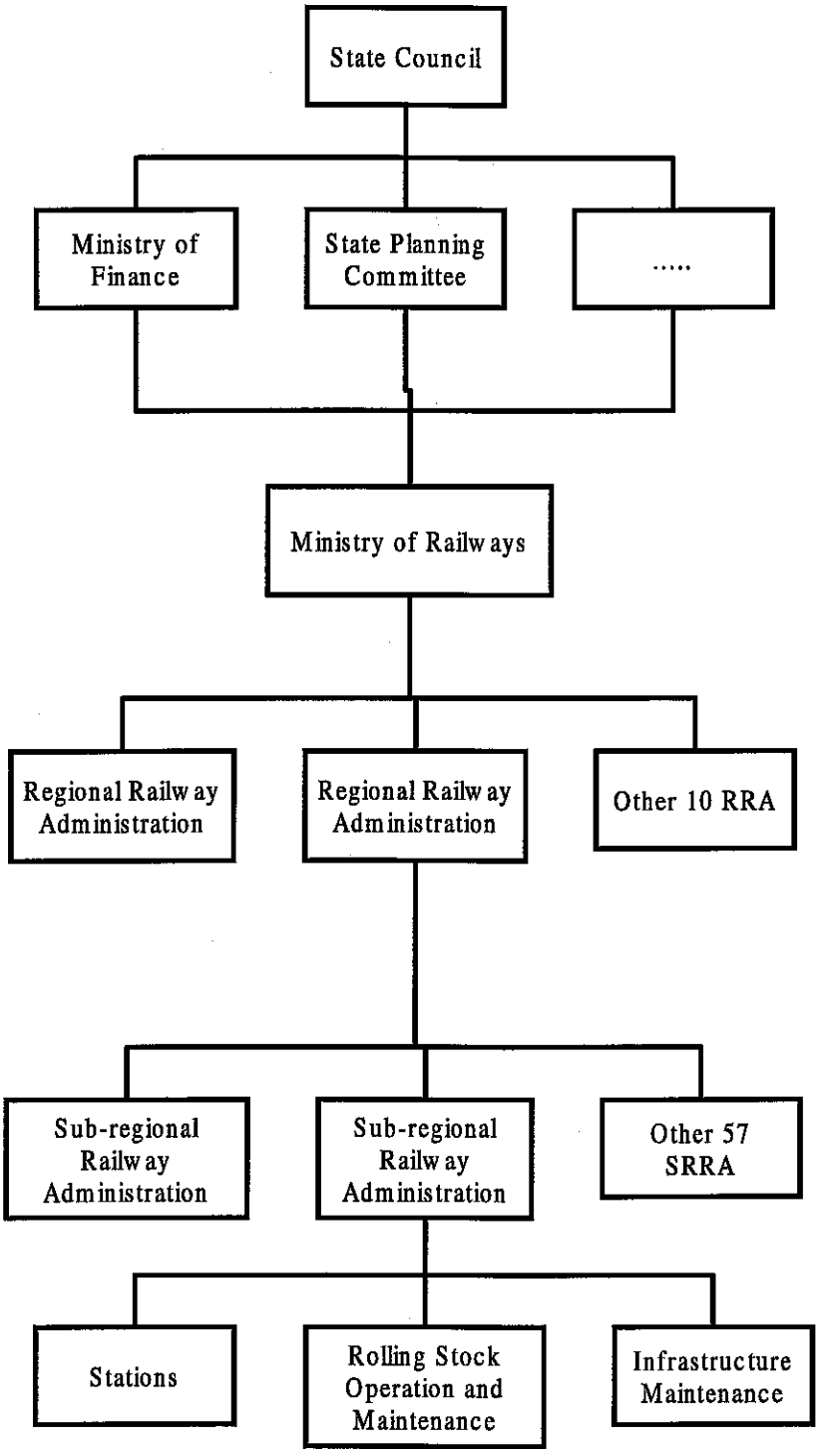

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Chart 1 Change of Market Share in China