Railway Enterprise and Economic Development: The Case of the Imperial Railways of North China, 1900-1911

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The belief that railway development could be the most efficacious means of generating economic growth was widespread among intellectual and bureaucratic circles in China at the turn of the twentieth century. Many people from these circles thought that investment in railways would lower transport costs and generate demand for industrial products. Thus, China's stagnant agricultural sector and weak industrial base would be stimulated. Railway development was not seen as one of a number of preconditions for industrialization, but rather as a process that inevitably led to modern economic growth.

The history of the Imperial Railways of North China (I.R.N.C.),[1] China's first rail enterprise, illustrates the fallacies of such an approach. Despite reasonably efficient management and high profits, the railway was unable to alter the economic environment in favor of modern economic growth because of the inherent limitations of railways as an innovative force and the presence in China of imperialism. Both Chinese and foreigners overestimated the potential benefits to agriculture and industry. Savings in transport costs actually turned out to

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be appreciably less than anticipated. Benefits to agriculture were further restricted because no system of local roads linking rail centers to rural markets was developed. On the other hand, the industrial stimulus provided by railways was weakened by China's vulnerability to foreign competition, a direct result of international treaties that prohibited the establishment of protective tariffs. Foreign imports, for example, captured most of the market for railway manufactures.

The failure of the I.R.N.C. to stimulate growth is of special interest because in some respects it was a classic financial success. After completion of the final sections of the main line between Peking and Mukden in 1903, the railway's annual net profits after service of the debt ranged from 10% to 20% on gross capital investment. These surpluses were utilized by the central government to finance the construction of new lines and offset losses of other railways. The Chinese management also circumvented most of the restrictions on Chinese rights that had been established by the British loan agreement of 1898. By 1910, the I.R.N.C. for all intents and purposes was under Chinese control (FO 405/2292, Nos. 33-59).

Thus, bureaucrats in the Ministry of Posts and Communications (Youchuanbu), known after 1912 as the Ministry of Communications (Jiaotongbu), and other observers in positions of influence frequently pointed to the I.R.N.C. as a model for developing wealth and power. In 1912, for example, Sun Yat-sen insisted:

> The railway question today is really a question of life and death. . . .If we now wish to build railways, we must welcome foreign capital. . . .I believe that foreign loans do not cause harm to the nation and also believe that borrowing foreign capital to build railways is wholly advantageous and without drawbacks. If we look at the lines which have been completed, there is not one which is not earning a profit. The I.R.N.C. is not yet fully developed, but its yearly profits are inestimable. The Peking-Suiyuan Railway has been built from its surplus profits. [Suri, 1961: Vol. 3, 65-66]

Unfortunately such a view is only a half truth. It obscures the unpleasant fact that the financial success of the I.R.N.C. was

atypical of most Chinese railways and that, despite its initial profits, it did not stimulate modern economic growth in the long run.

The first half of this article explores the I.R.N.C.'s business operations in an attempt to isolate the factors that contributed to its financial success, as well as its ultimate limit on economic development. It also investigates the problems of Chinese bureaucratic management and the impact of the imperialist presence in China on railway development. The second half explores the weak linkage between the railway and other types of economic activity.

BUSINESS OPERATIONS

FOREIGN FINANCING AND CAPITAL COSTS

The capital costs of a firm are an important factor in determining the rate of return on investment. Overcapitalization can increase operating expenses by adding to interest charges without increasing productivity. On the other hand, undercapitalization may prevent a firm from carrying out projects essential to its economic survival. During its first years, the I.R.N.C. suffered from chronic shortages of capital. Although the first seven miles of track were laid in 1881, political opposition and shortages of capital delayed significant progress for almost 15 years. By 1895 the government had completed only the sections between Tientsin and Shanhaiguan, and it was unable to push ahead with the projected extension into Manchuria.

Between 1895 and 1898 additional government appropriations and a series of short-term foreign loans enabled the company to extend the line from Tientsin to Peking. However, the I.R.N.C. lacked the capital to maintain the older sections in good working order or to complete the Manchurian extension. Only after the management requested and received a British loan for £2,300,000 was the I.R.N.C. able to finish the main line and undertake a program of renovation and improvement.

Although the I.R.N.C.'s failure to solicit a long-term foreign loan before 1898 led to serious delays in construction, it also forced the company to economize whenever possible. Most foreign-financed railways in China were built according to Western standards and in anticipation of future demand. Western engineers simply adopted procedures employed in the West while foreign creditors, who were guaranteed interest on their loans, displayed little interest in holding down expenditures. The resulting overcapitalization in comparison to operating income thus reduced the rate of return to levels which frequently were inadequate to cover interest charges.

The I.R.N.C. was a striking exception to foreign-financed railways. In the years prior to the British loan, the Chinese management and the British engineering staff, which had developed an intense loyalty to the company, were forced to pay close attention to all capital expenditure and carefully weigh the expected return on all capital outlays. The I.R.N.C. thus followed the American practice of building according to existing demand. All capital costs were held to the minimum consistent with safety and efficient operation. Even in 1916, after millions of dollars had been plowed back into a program of capital improvements, the I.R.N.C. was one of the cheapest railways in China.

Although the average capital cost per kilometer of Chinese railways in 1916 was $75,401, Table 1 reveals significant differences in the costs of individual companies.[2] The I.R.N.C. and the Peking-Suiyuan Railway, which was financed from the I.R.N.C.'s profits, were substantially cheaper than the foreign-built Shanghai-Nanking and Tientsin-Pukou railways. A portion of this difference can be attributed to methods used to finance interest and other banking charges while the lines were under construction. Until the line is opened to traffic and generating income, railways financed by loans must use part of the loan funds to pay interest. This expenditure, listed under financial accounts and classified as a capital expense, added more than $10,000 per kilometer to the cost of most railways built in China.

TABLE 1
Average Costs Per Km. in 1916

Railway	*Total capital costs*	*Costs (excluding financial accounts)*	*Costs (excluding financial accounts, rolling stock, and mechanical works)*
I.R.N.C.	$61,896	$61,416	$42,355
Peking-Hankow	76,817	62,414	48,993
Peking-Suiyuan	56,460	53,926	40,720
Shanghai-Nanking	93,196	83,021	66,223
Tientsin-Pukou	90,169	78,552	67,355

SOURCE: Ministry of Communications, 1917: Table VII.

However, the I.R.N.C. was able to use income from the already completed Peking-Shanhaiguan lines to cover interest charges. This meant that interest from the outset was classified as an operating expense, not as capital expenditure. Financial charges thus amounted to only $480 per kilometer for the I.R.N.C. As for the Peking-Suiyuan Railway, most of its capital consisted of direct government appropriations, not loans carrying interest and other banking charges.

Even after making due allowance for the cost of interest during the construction period, it is apparent that the I.R.N.C. was much less expensive than the Shanghai-Nanking and Tientsin-Pukou railways. The difference is even more glaring when account is taken of the I.R.N.C.'s unusually high expenditure for rolling stock and mechanical plant, which were required because of the density of traffic on its lines. The I.R.N.C. spent almost one-third of its capital on these items; other railways spent only 15% to 25% of their capital, excluding financial accounts, on such purchases.

After deducting for financial accounts, rolling stock and mechanical plant, the Shanghai-Nanking and Tientsin-Pukou railways still were 50% more expensive than the I.R.N.C. Higher land prices in south China and inflation account for only a small portion of the difference in construction costs. The most significant factor was the decision of the I.R.N.C. to build with

an eye towards economy and existing demand. Similar tactics were adopted by the Chinese engineers, many of whom had been trained or employed by the I.R.N.C., who were responsible for designing and building the Peking-Suiyuan Railway.

The I.R.N.C. concentrated on essentials. Whereas most railways used the 85 lb. rail, the I.R.N.C. initially laid down 45 lb. and 60 lb. rails except for the heavily travelled Peking-Tientsin line. One knowledgeable engineer noted that the 85 lb. rail was 33% more expensive than the 60 lb. rail and was not required unless traffic density exceeded 500 ton/miles per mile of traffic (Stringer, 1922: 130-131). Bridges and stations were equally unpretentious. In 1889 most stations were "brick or mud structures" (Kinder, 1891: 296). By 1905 the stations were still described as being "plain," with platform walls of "rubble masonry with a granite coping" (Rigby and Leitch, 1905: 301-302).

In addition, the I.R.N.C. constructed most of its rolling stock and bridgework in its own shops at Tangshan and Shanhaiguan. By 1916 the company had invested $2,368,000 in mechanical plant. Initially the I.R.N.C. had hoped that the shops would become an important supplier of equipment to other railways in China. Although its plans were frustrated by the lack of cooperation between China's railway companies and the desire of foreign engineers to purchase abroad, the I.R.N.C. derived substantial benefits from the shops. The shops adapted rolling stock to the specific needs of the line and eliminated the need to purchase costly and overly elaborate foreign-built equipment (Rigby and Leitch, 1905: 305-306).

Naturally the I.R.N.C. continued to improve the quality of its plant and equipment as the need arose. Between 1903 and 1910 it spent almost $13 million on capital improvements. Rolling stock, the most neglected item on Chinese railways, increased by almost 60%. The company also replaced all 45 lb. rails on the Tientsin-Shanhaiguan section with 60 lb. rails and introduced 85 lb. rails to the sections with heavier traffic. It substituted steel girders for timber beams on bridges and

lengthened several spans. All along the line stations were expanded and a new depot built in Tientsin (FO 17/1758, "Statement Financial Accounts, 1903"; FO 371/227, "Statement Financial Accounts, 1905 and 1906"; FO 228/2292, "Statement Financial Accounts, 1908, 1909 and 1910").

While the I.R.N.C. might have saved itself the trouble and expense of capital improvements by building in anticipation of demand, its policies were financially sound. By limiting capital costs, the company restricted its need for more foreign capital. This in turn improved net profits by keeping down interest payments and improving the ratio of earnings to gross capital investment. As a consequence, the I.R.N.C. had little difficulty generating the revenue to finance improvements. Of the $13 million spent on capital improvements between 1903 and 1910, a full $8,803,583 came from retained earnings; the remainder was taken from the unexpended balance of the loan funds. The statistics would be even more impressive if the millions of dollars diverted to the construction of the Peking-Suiyuan Railway were included.

The I.R.N.C. began with one important and unplanned advantage—Chinese government investment in the Peking-Shanhaiguan lines. Even in 1898, the foreign debt of the I.R.N.C. amounted to only 60% of capital. After 1905, when the railway began to repay the principal on the loan, the burden of carrying a loan was further lightened. Nonetheless, the decisions to hold down capital costs and retain a large percentage of earnings for reinvestment also greatly contributed to the financial solvency of the company.

In contrast, most foreign-financed railways were built in anticipation of demand and according to Western standards. Although this approach avoided the need for a major program of capital improvements, such as the I.R.N.C. was forced to undertake, it added appreciably to capital costs. When money is borrowed at 5% and requires repayment, excessive overcapitalization can lead a company into bankruptcy.

For instance, the lavishly equipped Shanghai-Nanking Railway provides a classic example of the dangers of overcapitalization.

In 1909, for example, it had interest charges of $1,662,000 and operating profits of only $581,000 (Youchuanbu, 1915: HT 2/88). In 1918 the Shanghai-Nanking Railway and the Tientsin-Pukou Railway returned an average of only 6.2% on investment, still inadequate to cover financial charges for interest and amortization, whereas the Peking-Hankow Railway earned 15.8% and the I.R.N.C. 22.7% (FO 405/229, Annual Report for 1919: 38).

In conclusion, the available evidence suggests that the I.R.N.C. made reasonable use of foreign capital and foreign technical assistance. This was the case because the I.R.N.C. continued to employ methods of construction and purchasing policies developed in the days before the British loan. By building according to existing demand and modifying standards to fit China's needs, it avoided the pitfall of overcapitalization. By insuring that the I.R.N.C.'s capital costs were low in relation to a realistic projection of operating income, the policies pursued by the Chinese management and foreign staff helped lay the groundwork for the line's financial success.

NATIONALISM AND BUREAUCRATIC MANAGEMENT

The I.R.N.C. was managed by the Ministry of Posts and Communications after 1906 and its operations reflected both the strengths and weaknesses of the Chinese bureaucracy. The most striking aspect of Chinese management after 1906 was its growing self-confidence and increased powers of control over the foreign staff, which found itself excluded from decision-making and confined to technical duties. This led to a noticeable growth of friction between some members of the foreign staff and their Chinese superiors. British complaints centered on the rapid promotion of young Chinese with limited experience over the heads of foreign staff members with long service on the railway. One Chinese director was uncharitably described as "a clerk of no standing who is entirely ignorant of all technical matters" (FO 228/2292, Morrison to Liang, Oct. 9, 1908).

Despite a slight reduction in efficiency because of such appointments, Chinese nationalism also served as a force for reform and improved management. The Ministry of Posts and Communications, anxious to keep the railway system out of the hands of foreign creditors and also to embark on a modest program of railway construction financed from railway surpluses, not foreign loans, strove to maintain profits at a high level. In this they were reasonably successful (see Table 2).

In 1905 net operating profits jumped to $10,029,000 as a result of large shipments of goods to armies in Manchuria during the Russo-Japanese War. Although profits never reached such peaks again during the remainder of the decade, the I.R.N.C. was a virtual gold mine. Return on gross capital investment normally exceeded 20% after 1904. Net profits after payment of interest never fell below 12% and frequently reached 20% of gross capital investment.

Moreover, there is no evidence that the management neglected maintenance or capital improvements to inflate profits. Between 1903 and 1910 gross traffic revenue and miles run for revenue more than doubled while operating costs increased by only 50%. That increased traffic led to an improved ratio of operating costs is not surprising given the importance of fixed charges in railway operations. Still it is noteworthy that the management kept nepotism within reasonable bounds and maintained a high level of technical proficiency without substantial increases in administrative overhead (see Table 3).

Despite these accomplishments, the Ministry of Posts and Communications was unable to completely eliminate corruption or get the staff to give a high priority to customer preferences. The Ministry's promotion policies made the directorship of the I.R.N.C. a stepping stone up the bureaucratic ladder for ambitious officials. According to Claude Kinder, engineer-in-chief of the I.R.N.C. from 1881 to 1910, the rapid rotation of directors adversely affected morale:

> So far the uncertainty caused by the rapid changes of official Head has had a very bad effect and few Chinese employees have any faith

TABLE 2
Income and Expenditures of the I.R.N.C. (in thousands of dollars)

	1903	*1904*	*1905*	*1906*	*1907*	*1908*	*1909**	*1910*
Income								
Passengers	2,217	2,627	5,135	5,755	5,046	4,895	6,043	5,141
Goods	2,280	3,011	7,417	6,317	4,652	5,861	7,532	5,394
Miscellaneous	18	209	300	244	193	256	414	244
Govt. traffic	136	90	80	66	52	51	353	148
Total revenue	4,658	5,946	12,943	12,191	9,944	11,067	14,345	10,928
Operating expenses								
Maintenance right of way	579	675	692	1,007	1,173	653	1,071	775
Maintenance rolling stock	917	1,079	1,356	1,500	1,448	1,529	2,254	1,637
Traffic expenses	228	248	317	315	310	375	495	404
General charges	554	539	538	606	753	518	731	655
Bridge works	35	---	8	---	---	---	---	---
Total oper. exp.	2,313	2,542	2,914	3,429	3,684	3,075	4,554	3,474
Net profit	2,342	3,404	10,029	8,761	6,260	7,992	9,791	7,454
Loan interest	1,405	?	1,186	1,058	?	1,172	1,492	1,135
Amortization	---	?	690	690	690	690	690	710
Int. on merch. shs.	198	?	---	30	?	21	25	25
Net Profit after interest	739	?	8,153	6,983	?	6,109	7,584	5,584

*Covers a fifteen month period as a result of the decision to make the calendar year the financial year.
SOURCES: FO 17/1758, "Statement Financial Accounts, 1903"; FO 371/227, "Statement Financial Accounts, 1905 and 1906"; FO 228/2292, "Statement Financial Accounts, 1908, 1909 and 1910."

TABLE 3
Administrative Expenses (Salaries, Office Expenses and Supervision)
(in thousands of dollars)

	1903	*1904*	*1905*	*1906*	*1907*	*1908*	*1910*
Category							
Maintenance dept.	76	116	134	164	165	108	174
Locomotive dept.	113	119	135	146	113	126	130
Traffic dept.	50	52	54	65	61	89	82
General charges	554	539	538	606	735	593	644

SOURCES: FO 17/1758, "Statement Financial Accounts, 1903"; FO 371/227, "Statement Financial Accounts, 1905 and 1906"; FO 228/2292, "Statement Financial Accounts, 1908, 1909 and 1910."

> in Rules and promises. The prevalent idea is to make as much money as possible before being cleared out to leave room for some favorite or relative of the next Director. [FO 228/2492, Doc. 53]

Institutionalized corruption and a lack of initiative always had been a problem at the lower ranks. The station masters and ticket collectors were the weakest link, much as the training of noncommissioned officers was a problem in the Chinese army. Station masters and yardmen were employed without special training or adequate supervision. There was "a general impression of slackness" and fertile opportunities existed for graft. According to Kinder, corruption at the lower ranks reduced profits by as much as 20% (FO 228/2492, Doc. 53).

Recruitment of skilled business managers and station masters was hindered by the low status of those positions. Ironically, British stress on engineering skills at the expense of nontechnical operations had the unfortunate effect of reinforcing traditional Chinese prejudices against petty commerce. The best talent of the I.R.N.C., both Chinese and foreign, avoided the traffic department. One unfortunate result was that the traffic department displayed little initiative in seeking out business or catering to customer needs. The I.R.N.C. did not provide adequate storage sheds but left freight out in the open where it could be damaged by wind and rain (Zeng, 1908: Vol. 2,

12-13). Supervision was so lax that one private shipping firm routinely seized control of freight requiring transshipment without obtaining permission from its "customers" (Tielu xiehui huibao, No. 4, Vol. 9, Sept. 1915: 14).

When a full account of abuses on the I.R.N.C. was presented to the Ministry of Posts and Communications in 1909 by Kinder, his last contribution to the railway, the Ministry immediately launched a major campaign to eliminate corruption and improve service. The appointment of station masters was transferred from the traffic department to the head office. The I.R.N.C. drew up a new set of regulations covering the use of passes and sale of tickets, formed a specialized police force and established a system of rewards for those reporting corruption (Jiaotong guanbao, Jan. 1, 1910: ch. 7/12b-13b; March 12, 1910: ch. 11/8).

These reforms were one part of a national campaign to maximize profits from the state railways in order to secure funds to finance new construction and redeem outstanding loan agreements that impinged on China's sovereign rights. On October 25, 1909, the Ministry of Posts and Communications announced the dismissal of 110 employees from the state owned railways. Of the four offenders important enough to be mentioned by name, three had been employed by the I.R.N.C. Shortly thereafter the Ministry announced the results of its first examination of lower echelon officials. Five station masters of the I.R.N.C. were recommended for promotion while 22 officials in the Ministry, selected for their knowledge of English and management, were named as station masters (Youchuanbu, 1915: HT 1/77, memorial dated October 25, 1909; Jiaotong guanbao, March 12, 1910: ch. 11/8).

Other steps were taken to make railway shipment more attractive. For the first time station masters were asked to provide information about the local economy, prices, commodities, markets, and the like. The number of trains increased and the I.R.N.C. negotiated a series of agreements providing for the transshipment of goods from one railway to another. The management also ordered the construction of new storage sheds

and sidings and the elimination of "tips" normally exacted by officials for unloading cars.

The Ministry's reform program entailed a relatively sophisticated appreciation of the obstacles to improved operations. It also suggests that modern nationalism established certain limitations on the amount of corruption and inefficiency that the Ministry would tolerate. However, the effectiveness of these reforms is open to question. Profits did not rise appreciably in 1910. Moreover, the same pattern of indifference to customer needs was reported in the 1920s. When the traffic manager of the I.R.N.C. visited the extramural lines in 1921, he found it impossible to locate timetables and handbooks of fares of the I.R.N.C., even in the main station at Yingkow! The extramural sections still lacked adequate storage facilities and many merchants using the railway were compelled to use middlemen, forwarding agents, and watchmen to insure safe and rapid delivery of goods. In all likelihood, this situation was a continuation of patterns existing prior to 1911, but it also is possible that the quality of management had deteriorated still further in the intervening decade (FO 228/2798, General Series, No 37, British consul in Newchwang to Alston, Nov. 8, 1921).

Other problems that reduced the efficiency of the I.R.N.C. were beyond the control of the Ministry and management. The infamous *likin* tax added to shipping costs and probably reduced the volume of freight on the intramural lines while driving business from the extramural lines to the South Manchurian Railway. Repeated protests by the Ministry led to a temporary commutation of likin at rail stations in Manchuria, but elsewhere local officials insisted on its retention (Ministry of Communications, 1930: Zonggang, 2509-2510). Underutilization of the mechanical plant at Tangshan and Shanhaiguan resulted from the Ministry's refusal to reduce prices to attract business. The rate schedule for freight also might have been lowered and the directors probably should have paid more attention to elasticity of demand when setting prices. However, the overwhelming fear that such risk-taking might result in the loss of profits and default to foreign creditors was a powerful deterrent to adventurous entrepreneurship.

The various internal weaknesses in the management of the I.R.N.C. are not surprising given the Chinese inexperience in railway management and the preoccupation with the need to subordinate the foreign staff to Chinese control. For all its failings, the Ministry of Posts and Communications was relatively sensitive to the problems created by corruption and indifference to customer needs. Convinced that rights recovery and future developmental schemes required greater profits from the I.R.N.C., it made a reasonable effort to initiate reforms.

IMPERIALISM AND BUSINESS OPERATIONS

The most serious problems confronting the I.R.N.C. after 1906 came not from the presence of foreign advisors and capital in the I.R.N.C., but from external pressures created by the imperialist presence in China. This was most noticeable in three areas: the decision to set prices on the basis of average costs, the administrative expenses and inefficiency resulting from the failure to integrate the operations of the state railway system, and the artificial advantages enjoyed by the South Manchurian Railway in its competition with the I.R.N.C.

Most Chinese railways, including the I.R.N.C., based their rates on average costs (that is, the average cost of running a train, based on fixed overhead costs as well as the actual cost of operating the train; FO 228/2492, Doc. 53; Youchuanbu, 1915: HT 1/52/57, memorial dated May 18, 1909). This policy was designed to maximize profits by keeping prices high. It reflected the Ministry's belief that its immediate task was to keep China's railways out of the hands of foreign creditors. In 1909, four of the seven state-owned railways were operating at deficits that were covered by the profits of the I.R.N.C. and the Peking-Hankow Railway. The Ministry also planned to use the balance of profits to build the Peking-Suiyuan and Kaifeng-Hsuchow Railways without foreign loans.

But keeping prices high also had the adverse effect of seriously reducing the potential value of the I.R.N.C. as a force for economic growth. Kinder believed that the I.R.N.C. could

have reduced fares by 50% and still have earned a profit of 10%. Arguing that the primary purpose of a government-owned railway ought to be the stimulation of trade, he described the 20% profits then being reported by the I.R.N.C. as a cause for shame (FO 228/2492, Doc. 53).

Although Kinder never appreciated the importance of the I.R.N.C.'s surpluses to the Ministry—a drop in profits from 20% to 10% would have been disastrous—he was correct in asserting that a rigid adherence to average costs in all cases was counterproductive. Fixed overhead costs accounted for almost 50% of average costs in railway operations. It thus would have been possible to run additional trains at marginal cost (the actual operating cost of running one more unit) without losing money. Unfortunately, the I.R.N.C. refused to consider marginal costs and elasticity of demand. Convinced that trains would lose money if run at less than average cost, the I.R.N.C. set the price for transporting stone ballast from Tangshan so high that the Tientsin-Pukou Railway adopted the unusual practice of burning clay for ballast. "The officials of the I.R.N.C. want absurdly large profits and forget that all these lines are part of the state network" was Kinder's damning verdict (FO 228/2492, Doc. 53).

Ultimately the I.R.N.C. made a few adjustments to attract new business. In 1909 it slashed the rates charged for soya beans going from Mukden to Yingkow by 50% and initiated a system of rebates and discounts for bulk shipments in Manchuria (Ministry of Communications, 1930: Jing-Feng tielu, 462). These, however, were emergency measures taken to meet competition from the South Manchurian Railway. In normal operations the I.R.N.C. remained obsessed by the idea of recovering average costs and never sought to test the elasticity of demand. There would be no experimentation while foreign creditors stood in the wings.

Imperialism also made it impossible to establish a rationally administered system of state railways. The scramble for concessions left a legacy of independent railways influenced by foreign staffs and run according to principles established by

foreign creditors. Everywhere there was underutilization of physical plant and staff as each company sought to be self-sufficient. Forty patterns for freight cars were used by Chinese railways in 1909 when six would have sufficed. The resulting confusion increased maintenance costs and the expense of spare parts (FO 228/2492, Doc. 53). In a similar fashion, the administrative expenses of railway companies were out of all proportion to their actual mileage because of the need to maintain separate administrative structures as established by the loan agreements. Arrangements for through traffic and borrowing of rolling stock and equipment were virtually non-existent. It was not until 1908 that the I.R.N.C. reached an agreement with the Peking-Hankow and Peking-Kalgan railways covering through traffic. As late as 1924 writers on railway economics still complained about the lack of cooperation among railways in transferring rolling stock (Zeng, 1924: 304-305, 386).

Thus, the magnificent workshops of the I.R.N.C. never were developed into a center servicing the whole of the Chinese railway system. Not only did this preclude the emergence of a manufacturing center that might have reduced Chinese dependence on foreign imports, it also meant that the shops operated well below capacity. Frequently their volume of business was inadequate to meet fixed charges for equipment and personnel. Part of the problem was the desire of foreign engineers to purchase abroad, either in response to pressure from foreign firms or because they were unwilling to adapt specifications to take advantage of the Tangshan and Shanhaiguan products. The Tientsin-Pukou Railway could have saved Tls. 1 million if it had been willing to use 200 foot bridge spans produced at Shanhaiguan instead of importing 400 foot spans from Germany (FO 228/2492, Doc. 53).

On the other hand, there was little inducement for other companies to purchase from the I.R.N.C. The Guangxi [Kwangsi] Provincial Railway Company bought rolling stock from Tangshan only to discover that foreign imports were cheaper. Ironically, a 20% price reduction might have enabled

the workshops to operate at full capacity and at a profit by attracting new business. As was true for freight rates, the I.R.N.C. and the Ministry of Posts and Communications were immobilized by fears that lower prices meant lower profits.

The negative impact of imperialism was even more pronounced in Manchuria, where the I.R.N.C. faced competition from the Japanese-owned South Manchurian Railway (S.M.R.). Geography was a natural ally of the S.M.R. Its line passed through the most fertile agricultural districts of southern Manchuria and had first call on the river trade of the Liao River. Dairen with its ice-free deep water port and marvelous harbor facilities was far superior to Yingkow, the old import-export center of Manchuria and main outlet for the I.R.N.C. in Manchuria. Yingkow was ice-bound for four months and could not accomodate ocean going vessels without the use of lighters (IMC, 1922: 83-98; Minami Manshu tetsudo kaikushiki, 1917: 405-451). Moreover, the I.R.N.C. did not extend beyond Mukden and lacked direct access to the interior so well served by its rival. To make matters worse, its Yingkow-Mukden branch line was 263 kilometers in length compared to 179 kilometers for the S.M.R.

These were not insurmountable obstacles if the I.R.N.C. had possessed the freedom to develop additional branches and feeder lines. Unfortunately, China had been forced to recognize Japan's inheritance of Russian rights in South Manchuria when it signed the Treaty of Peking in December 1905. One of the most vexatious limitations was the Chinese commitment not to construct "any main branch in the neighborhood or/and parallel to that railway (the South Manchurian Railway), (or) any branch line which might be prejudicial to the interests of the above mentioned railway" (MacMurray, 1921: Vol. I, 559).

From the outset the Japanese gave notice that they took a very broad interpretation of that clause. In the spring of 1907 Peking opened negotiations to recover several military lines built by the Japanese during the war. Although the Hsinminding-Mukden and Kirin-Changchun railways were recovered in June after a bitter dispute, Peking was compelled to accept

Japanese loans to finance their conversion to standard gauge. The Hsinminding line was incorporated into the I.R.N.C., although China was required to employ a Japanese engineer on that section. Meanwhile, a deadlock developed when the Japanese refused to allow the I.R.N.C. to bring its line across the S.M.R. and into the heart of Mukden. Only in 1911, after China offered counter-concessions, did the main line of the I.R.N.C. enter the inner city of Mukden (FO 405/181, No. 26, Jordon to Grey, June 25, 1907; Ministry of Communications, 1930: Jin-Feng tielu, 74-87, 100-101).

Of greater significance and controversy was the Chinese plan to construct a trunk line west of the Liao River running from Hsinminding through Fakumen to Tsitsihar. The line was to be treated as an extension of the I.R.N.C. and built with a £3 million loan from the British and Chinese Corporation. Only the first section from Hsinminding to Fakumen was announced when the plan was unveiled to the public in late 1907. As initially conceived, the primary purpose was to draw British capital into Manchuria as a counter to Japanese influence. Publicly, Tang Shao-yi and Hsu Shi-chang, the chief promoters of the scheme, insisted that they were merely fulfilling a legal obligation to apply to the Corporation for capital. They also argued that the extension would serve a distinct geographic region without adversely affecting the S.M.R. In private, however, Tang sometimes spoke as if the extension would enable China to apply more pressure on the S.M.R. In June 1908, he told the British consul in Mukden that China would make an offer to purchase the Russian-controlled sections of the S.M.R., which then were operating at a loss (FO 228/2386, Doc. 44, Willis to Jordan, Jan. 18, 1909).

Despite such dissemblance, the Chinese had a strong case. Field studies by British authorities in Manchuria confirmed Chinese claims that their extension would serve a region distinct from that served by the S.M.R. In the past, the natural trade routes of western Manchuria and Inner Mongolia had gone through Fakumen or Hsinminding and then to northern China or Yingkow via the Liao River or I.R.N.C. By 1908 50% of this

trade had been drawn to the S.M.R. and Dairen. According to A. Hosie, British consul in Mukden, the proposed Chinese extension would have restored the situation by serving

> a rich agricultural region with its hinterland which has at the present only a very limited connection with the S.M.R., whether at T'iehling or any other station to the north or south of it. [FO 228/2386, Enc. in 82, Report of Hosie, Oct. 21, 1908]

However, Japanese protests against the proposed extension seemed to imply that any Chinese railway in Manchuria not designed as a branch of the S.M.R., even one west of the Liao River, was either "parallel" to or "in the neighborhood of" the S.M.R.

British diplomatic officials in Tokyo and Peking, accepting the findings of their consuls, initially sought to mediate the dispute. But Whitehall had no intention of disputing its Japanese ally. Once the Japanese published the full text of the Treaty of Peking, the British reluctantly accepted the broad Japanese interpretation of the geographic scope of the ban against competing railways. The British also were unwilling to establish a precedent of allowing the Chinese to unilaterally determine what constituted a competing railway—most British railway loans contained provisions prohibiting construction of parallel lines (FO 228/2386, Doc. 45, Jordan to Grey, Jan. 23, 1908; Doc. 47, Jordan to Willis, Jan 28, 1908; FO 405/183, No. 16, Jordan to Grey, June 9, 1909). After the withdrawal of British diplomatic support the issue no longer was in doubt. Subsequent Chinese efforts to revive the scheme in various guises came to naught, for China lacked the power to confront Japan on its own.

The collapse of the Fakumen railway extension gave Japan a virtual veto over all future railway construction in Manchuria. Limitations on Chinese sovereignty also crippled the operations of the I.R.N.C. and Chinese political and economic developmental schemes for western Manchuria and Inner Mongolia. The I.R.N.C. was not permitted to push its line northward to tap the river trade on the Liao River above Mukden or develop branches

to the northwest to recover the trade of Inner Mongolia and western Manchuria.

THE I.R.N.C. AND ITS COMPETITION

Except for the S.M.R., the I.R.N.C. did not face competition from other modern transportation industries. The major rail lines in northern China were in effect feeders and branches of the I.R.N.C. The Peking-Suiyuan and Peking-Hankow railways found access to the sea and Tientsin via the I.R.N.C. while the Tientsin-Pukou Railway used the I.R.N.C. to reach Peking. In addition, the Tientsin-Peking section of the I.R.N.C. was on the main trade artery of northern China. For centuries this route had connected a vast hinterland to the sea and the imperial capital. As a result of its location and the absence of modern competition, the I.R.N.C. dominated passenger service and freight shipments requiring safe and speedy transit.

However, the I.R.N.C. faced strong competition from more traditional forms of transport on the internal waterways of northern Hebei [Hopei] and Manchuria. At both ends of its route the I.R.N.C. paralleled the main river systems of Hebei, the Bai River, and of Manchuria, the Liao River. From Tientsin to Shanhaiguan it was intersected at right angles by rivers draining a large hinterland. Many of these rivers, especially the Luan, gave the I.R.N.C. access to the inland trade of the region. However, goods shipped by water could reach Tientsin via coastal shipping or by the Ji Canal, which paralleled the railway from Lutai to Xukezhuang.

The supremacy of railways over other forms of transportation is only partly determined by the relative costs charged. Railways are also able to provide special services, such as speed, year round usage and dependability, that may be essential for certain commodities. The relative cheapness of railways was decisive in Manchuria, whereas the intangible services offered by the I.R.N.C. were more important in northern Hebei.

The river systems of northern Hebei and Manchuria were unsuitable for year-round use. They were closed for four months by the winter freeze and hampered by silting and low

water during the summer. For passenger service and goods requiring speed, safety, or year-round transportation the river-canal system was inadequate. In terms of costs, however, the waterways of northern Hebei were relatively cheap. In 1919 it cost 1.6-2.0 cents per ton/kilometer to ship goods upstream on the Bai river from Tientsin to Tongzhou. The going rate for freight sent from Tientsin to Lutai via coastal shipping and the Ji Canal was approximately 1.5-3.3 cents per ton/kilometer. (Tōa Dōbunkai, 1920: Vol. 18, 401, 420-421). In Manchuria, however, in the period 1899-1907, shipping downstream on the Liao River was substantially more expensive, averaging 4.0-6.0 cents per ton/kilometer (FO 405/77, No. 93, Report by Hosie; Gaimushō, 1907; 563-597).

Traditional overland transportation in both northern China and Manchuria was expensive and less suitable for a modern economy. Chinese carts had a limited capacity, were slow, and summer rains frequently turned roads into impassable quagmires. Long-distance transportation in Manchuria usually was confined to the winter months when men and animals were released from farm work and the frozen roads allowed for heavier loads and greater speed. At the turn of the century it cost 6.0-7.4 cents per ton/kilometer to ship goods in Manchuria. Short-distance cartage was even more expensive and rates of $.50 per ton/kilometer were not uncommon (Gaimushō, 1907: 569-570; FO 405/77, No. 93, Report by Hosie; Tōa Dōbunkai, 1908: Vol. 5, 50-61).

Table 4 provides a list of railway rates for comparison. These are based on published rates for the I.R.N.C. and do not include handling charges or insurance, which could add another 35% to the fares (Gaimushō, 1907: 569-570). Nor does it take into account the expense of bringing goods to and from railway centers. Farmers interviewed by John Buck in 1937 estimated that it cost 5.4 cents per ton/kilometer to ship by rail, double the published rates for Chinese railways when all other expenses were included (Buck, 1937: 350-357).

In Manchuria the railway held a decisive edge over both junk and cart trade in terms of service offered and price. Not surprisingly the railway virtually destroyed its competition. In

TABLE 4
Freight Rates for the I.R.N.C.

1st class (manufactures)	General rate	3¢ per ton/km.
2nd class (agricultural goods)	General rate	2¢
3rd class (minerals)	General rate	1.05¢
bulk goods (special rate)	Mukden-Yingkow	1.8¢
beans (special rate)	Mukden-Yingkow	1.5¢
coals (special rate)	Kaiping Mines	0.72¢

SOURCES: Ministry of Communications, 1930: Jing-Feng tielu, 460-69. Although no date is given for these rates, they are not out of line with fragmentary figures cited by I.R.N.C. officials circa 1910.

1899, 20,000 junks plied the Liao River; 30 years later the figure had declined to 3,000 (Hall, 1930: 278-292). Soya beans reaching Yingkow fell from 255,922 tons in 1909 to only 80,000 tons in 1918 (Mantetsu chōsabu, 1918: 43-44, 48-50, 86, and 100). The same was true for the cart trade. At the turn of the century over 22,000 carts and 150,000 animals had been employed to bring grain to markets and river ports (FO 405/77, Enc. 1 in No. 150, Report of Hosie). By 1911 customs officials in Yingkow reported: "the main roads have fallen into disuse by reason of the competition of the railways. . . .Branch roads have been made to connect markets with the railway and markets thus connected have developed into towns of more or less importance" (IMC 1912: 139-140).

The railway also dominated the junk trade in northern Hebei. By 1902 the I.R.N.C. had captured most of the trade between Tongzhou and Peking, which once had employed 60,000 boatmen and carters (IMC, 1903: 54). As early as 1906 railways accounted for 48% of goods arriving in Tientsin from the interior, and this percentage continued to increase (see Table 5).

In northern Hebei, unlike Manchuria, the junk could come close to matching freight rates offered by railways for most commodities except for minerals. Passengers and minerals normally went by rail as did goods, such as manufactures and perishables, which required speed and dependability. But nonperishable bulk goods, especially those that could be stored over the winter, oscillated between railways and junks. In the

TABLE 5
Goods Arriving in Tientsin from the Interior
(in percentages)

Means of conveyance	*1906*	*1912*	*1914*	*1917*	*1921*
All railways	48	53	55	68	71.5
Overland (cart)	7	?	4	?	?
Bai River	?	3	3	3	2.5
Grand Canal	15	13	?	7	5
Baoding River	19	21	?	13	11
Chi Canal	?	7	?	5	7

SOURCES: IMC, 1922: 31; IMC, 1907: Part II, Vol. I, 160.

mid-1920s, when traffic was disrupted by warlord conflicts and the railways increased rates to make good losses, shippers of agricultural produce simply went back to using the traditional transportation networks (IMC, 1932: 376-377).

Field studies conducted by the I.R.N.C. in 1937 confirm the fact that the railway was not indispensable to the agricultural sector. Close to 50% of local produce from the districts contiguous to the Ji Canal went to market by boat. The survey also reported large shipments of cotton, peanuts, salt, rice flour, and other staples being shipped on the Bai River in preference to the I.R.N.C. In most cases the railway was more expensive or the cost of transshipment and handling charges were too high to merit transferring goods to the railway (Bei-Ning Tielu Guanli Ju, 1937: 1713, 1729-1760, 1939-1974, 2003-2015).

In Manchuria the I.R.N.C.'s main competition came not from traditional forms of transportation as in Hebei, but from the S.M.R. As has been noted earlier, Japanese diplomatic opposition to extensions of the I.R.N.C. left the railway at a distinct disadvantage when competing for trade passing down the Liao River or coming from Inner Mongolia and western Manchuria.

In 1909 the Ministry of Posts and Communications inaugurated a campaign to improve the I.R.N.C.'s competitive position. It agreed to pay Manchurian officials Tls. 50,000 per year in return for the abolition of likin on all railway goods (Ministry

of Communications, 1930: Zonggang, 2509-2510). The same year the management of the I.R.N.C. announced reduced rates for bulk goods from Mukden to Yingkow and a new system of special discounts. These reforms marginally increased the I.R.N.C.'s share of the bean trade, but the improvement was both temporary and of limited value (see Table 6).

After a brief increase in freight in the year 1910-1911, the I.R.N.C.'s share of the bean trade dropped dramatically. Undoubtedly many factors contributed to the loss of trade to the S.M.R. During the final years of World War I the I.R.N.C. was plagued by an acute shortage of rolling stock. Moreover, the growing weakness of the central government allowed Manchurian authorities to reimpose local taxes on railway freight. In 1921, for example, the rate for a car load of sugar or cotton shipped by the S.M.R. was half that of the I.R.N.C. after taxes had been added (FO 228/2798, No. 37, British consul in Newchwang to Alson, Nov. 8, 1921). Inefficient management and the failure to provide adequate facilities for customers added to the problem. Even in the late 1920s, when the development of the ice-free harbor at Hulüdao offered an alternative to Dairen and the fall in the price of silver allowed the I.R.N.C. to underprice the S.M.R., shippers using the I.R.N.C. were compelled to sacrifice a degree of reliability.

Thus, inland waterway transport in Hebei posed serious competitive problems for the I.R.N.C. Moreover, its most formidable competitor in the modern transport field, the

TABLE 6
Shipment of Soya Beans in Manchuria
(in thousands of tons)

Year	*Dairen (S.M.R.)*	*Yingkow (I.R.N.C.)*	*Yingkow (S.M.R.)*	*Yingkow (Junk)*
1908-1909	616	82	65	259
1910-1911	562	137	72	238
1913-1914	870	61	70	77
1915-1916	938	46	65	114
1917-1918	1,204	13	77	80

SOURCES: Mantetsu chōsabu, 1918: 43-48, 50, 86, 100.

S.M.R., outperformed the I.R.N.C. at most levels of management and service. It also had a more favorable location that gave it first call on the carrying trade of the Liao River and the shortest route from Mukden to the coast. In addition to these advantages, the S.M.R. enjoyed special rights and privileges that provided immunity from local Chinese taxes. As the failure of the I.R.N.C.'s 1909 reforms to attract new business demonstrated, improved management and lower shipping rates were insufficient to offset the special advantages enjoyed by the S.M.R.

THE ECONOMIC IMPACT OF THE I.R.N.C.

TRADE, DEVELOPMENT AND FORWARD LINKAGES

Forward linkage effects—the impact on all industries and economic activities that use railways and thus have their costs lowered by cheaper transport—depend in part on the magnitude of savings in transport costs and the strength of the local economy. Railway development in China proper accelerated the growth of foreign trade and treaty ports, and increased the commercialization of agriculture. It did not, however, lead to modern economic growth in either the industrial or agricultural sectors.

The I.R.N.C. and most other Chinese railways were designed to link treaty ports to the interior. The three main shipping centers of the I.R.N.C. were Yingkow, Tientsin and Jinwangdao. In addition to local produce bound for these urban markets and Peking, large quantities of export items—coal, cotton, beans, fruit, animal skins, peanuts, and the like—reached Tientsin from the interior via the Peking-Suiyuan, Peking-Hankow and Tientsin-Pukou railways. The Kaiping Mines provided close to three million tons of coal per annum and large quantities of cement. In return, the I.R.N.C. funneled foreign imports into the interior. Tientsin, the main trading entrepot of northern China, was the magnet that determined the flow of goods.

Manchuria also witnessed a massive increase in foreign trade with exports exceeding imports. Most of the trade went via the S.M.R. to Dairen. As Dairen displaced Yingkow as the main trading center, the I.R.N.C. relegated its Mukden-Yingkow line to the status of a branch; the Shanhaiguan-Mukden section thus became the main trunk line of the I.R.N.C. in Manchuria. There was a thriving trade between the wheat producing areas of Manchuria and the grain deficit counties near Tangshan. A bad harvest in northern China inevitably led to substantial increases in the volume of agricultural produce carried by the I.R.N.C. In return, the grain deficit counties used the I.R.N.C. to export to Manchuria local handicraft goods, such as rush mats, native cloth, salt, pots, felt shoes, and some coal and cement (Bei-Ning Tielu Guanli Ju, 1937: 1-27, 1519-1698). A pattern of seasonal migration to Manchuria also developed, with coolies, peddlers and salesmen entering Manchuria during the peak seasons and returning home for the winter. Yet the volume of interregional trade was relatively limited, with most of the freight bound for regions close to the Great Wall.

The primary beneficiary of railway innovation in the region served by the I.R.N.C. was the mining industry. Special rates for coal offered by the I.R.N.C. were one-fourth the rates for ordinary produce on the Chi Canal. More important, the local canal system could not have handled the necessary volume of freight on a year-round basis. In fact, the initial impetus for the construction of the first section of the I.R.N.C. was the absolute necessity of providing cheap overland transportation for the products of the Kaiping Mines. Coal accounted for approximately 60% of all tonnage, 50% to 60% of ton/kilometer of freight and 30% to 40% of freight revenue (Ministry of Communications, 1917-1933; Bei-Ning Tielu Guanli Ju, 1937: 1761-1792). Cheap and easy access to the markets of Tientsin enabled Tangshan to become the largest producer of coal in China. The importance of the railway to mining development is indicated by the fact that the coal fields near Tangshan, which contained only 1% of China's then known reserves, accounted for 20% to 25% of annual coal production (Bei-Ning Tielu Guanli Ju, 1937: 1923-1938; Wang, 1947: 42,

50-62; Yang, 1940: Vol. 2, 260-272). A subsidiary trade in cement, limestone, and metallurgy soon developed in that area.

Despite the promising start provided by mining operations, there was no significant development of heavy or medium industry in the areas served by the I.R.N.C. A number of small factories manufacturing soap, cigarettes, matches, glassware, and so forth began to appear in Tientsin around 1911, but the I.R.N.C. and other railways simply could not provide the stimulus for large scale industrial growth. The high cost of capital in China made it difficult to finance capital-intensive industries and raised production costs above those of comparable products imported from abroad. Savings in transport and energy costs, the two major contributions of the I.R.N.C., were not enough to compensate for the lack of tariff protection and the fact of stiff foreign competition.

Although the evidence is not conclusive, railway innovation in the vicinity of Tientsin probably benefited exports more than imports. This, of course, might have been expected: Chinese exports consisted of raw or semi-processed agricultural goods requiring bulk shipment. But although exports grew more rapidly than imports, Tientsin retained an unfavorable balance of trade (see Table 7).

Foreign and Chinese imports to Tientsin grew steadily between 1880 and 1896, years in which China's entire railway system consisted of a single line between Tientsin and Shanhaiguan. Between 1896 and 1902 imports to Tientsin climbed dramatically. However, this increase probably reflects the impact of the Treaty of Shimoneski, not the completion of the Peking-Tientsin section of the I.R.N.C. After 1902 imports remained static for the remainder of the decade despite extensive railway construction in the area.

Export expansion also had been growing in an impressive manner from 1880 onwards, but it began from a very low base. In contrast to imports, the highest growth rates were recorded between 1902 and 1911, when four major trunk lines were constructed near Tientsin. The following decade saw the rate of increase level off, suggesting that a significant portion of the

TABLE 7
The Trade of Tientsin
(in millions of H.K. taels)

Date	*Foreign imports*	*Chinese imports*	*Exports*	*Deficit*
1880	10	9	2	16
1890	17	12	5	24
1896	29	13	8	34
1902	53	22	13	62
1911	52	24	39	34
1921	114	47	64	97
1931	135	82	133	84

SOURCES: IMC, Returns of Trade, by year. "Annual value of whole trade of each port."

1902-1911 spurt was due to the diversion of trade to Tientsin, not to expanded production in the countryside.

Unfortunately, it is impossible to pinpoint the respective roles of world demand for raw cotton and oil-bearing products, price changes brought about by currency exchange rates, and improved transport facilities in export expansion. In discussing the appearance of new cash crops among export items—cotton, beans, peanuts, rapeseed and the like—customs officials were inclined to give some of the credit to railways:

> Improved facilities for railway transport have contributed to this improvement. Goods which formerly had to be carried all the way to this port by camel, cart, or by boat, with innumerable delays and the probability of damage or loss inseparable from such means of conveyance are now carried by the old methods only as far as the railway station nearest to the locality of their origin, and thence forwarded by train to Tientsin, saving many days and at greatly reduced risks. [IMC, 1912. 200]

It also is difficult to determine whether the I.R.N.C. was responsible for changes in land use and agricultural production. A degree of commercialization of agriculture occurred in the regions served by the I.R.N.C., especially to the northeast of Tientsin. Some 18% of cotton arriving in Tientsin came from

this area. Maps produced by Japanese researchers show cotton growing districts in a thin finger running parallel to the I.R.N.C. all the way from Tientsin to Mukden (Mantetsu chōsabu, 1940. 14; Mantetsu kogyobu nomunka, 1928: 37). These same counties also produced large quantities of peanuts for export and sale in Tientsin. However, there is no indication of a similar shift to cash crops along the Peking-Tientsin section of the I.R.N.C. As Ramon Myers has noted, "No fixed pattern can be found in this province [Hebei] whereby counties around major cities or along transport routes specialized in cash crops" (Myers, 1970: 191-192).

Despite the impressive expansion of trade and the increasing utilization of cash crops—as well as the earlier cited diversion of river traffic to railways—one must be careful not to overstate the importance of the railway. First, the I.R.N.C. never was indispensable to the functioning of the rural economy. It obviously provided more dependable service and enough benefits to attract customers, but it was not a revolutionary breakthrough in terms of transportation costs. A significant portion of the freight, except for coal, consisted of goods diverted from river and coastal shipping or from inland centers to treaty ports. This river-canal system offered a reasonable alternative means of transportation for most agricultural goods. During the warlord conflicts of the mid-1920s, when the railway system in northern China was disrupted and overpriced, farmers still were able to get goods to market. One Japanese study of the cotton industry reveals that while the percentage of cotton arriving in Tientsin via rail declined from 74% in 1923 to 7% in 1926, the total volume remained constant (Mantetsu chōsabu, 1940: 308).

In fact, the volume of agricultural tonnage originating on the intramural lines of the I.R.N.C. was unimpressive. Only 5% to 7% of total freight originating on the intramural lines consisted of agricultural goods. Equally significant is the fact that these goods were carried an average of only 100 kilometers, a distance too short to have a serious impact on pricing. Railways may have accelerated a process that had begun by bringing a larger portion of the hinterland into the orbit of treaty ports such as

Tientsin. But given the impressive volume of junks on the Bai River prior to completion of the I.R.N.C. and the willingness of farmers to use the Luan River and Chi Canal as late as 1937, there is no reason to assume that railways were a prerequisite for commercial agriculture in the areas served by the I.R.N.C. The decisive factor was market price, and in Tientsin the market price was set by foreign demand.

Second, the I.R.N.C. appears to have produced what William Skinner has termed "false modernization." Modern transport reduced the cost of shipping between "the hubs of various trading systems," but:

> True modernization occurs only when a modern transport network is developed *within* an already commercialized central marketing system to the point where the standard markets of the system are obviated and die. By contrast, commercialization without intrasystematic transport improvement amounts to a kind of false modernization. [Skinner, 1965: 216]

The Qing government and its successors ignored "intrasystematic transport improvement." The term "*lu*" or overland transportation in the Department of Land Communication in the Ministry of Posts and Communications in effect meant railways. Most foreign experts believed that improved roads could have doubled the efficiency of animal-drawn carts (IMC, 1932: 295). However, there is not a single mention of rural communications or local roads in any of the memorials presented by the Ministry of Posts and Communications between 1906 and 1911. And indeed, reports of customs officials suggest a general and continuing decline in the efficiency of local waterways and, to a lesser extent, of local roads (IMC, 1922: 101, 109; IMC, 1908: Part II, Vol. 1, 31-32). Yet it was precisely the staggering cost of short haul shipping between railway centers and local markets that reduced the impact of railway innovation.

In like measure, increased commercialization of agriculture as a result of trade expansion and railway development did not lead to modernization of agricultural techniques or dramatic increases in agricultural output. A densely populated province

such as Hebei did not contain large tracts of fertile land ready to be put into production once reduced transport costs made it commercially feasible to ship goods to commercial markets. True modernization of agriculture required improved technology. Probably this would have entailed substantial investment in tools, irrigation, fertilizer, and new seeds. Unfortunately the rural elite, the group possessing the necessary capital and managerial skills, did not take an active interest in agricultural modernization. Those who actually worked the land suffered from chronic shortages of capital and, uncertain about fluctuations in market prices, were reluctant and/or unable to make substantial capital investment in agriculture.

In Manchuria, however, railways had powerful forward linkage effects because they were introduced into a comparatively underdeveloped economy with potential for expansion. Soya beans were in demand on the world market. Even before the introduction of railways, exports of beans had been increasing in an impressive fashion. Furthermore, there was a genuine need for improved transport. The traditional forms of transportation were expensive and unsatisfactory for year-round shipping. Manchurian railways thus provided important reductions in transport costs and helped make possible the exploitation of crops and mineral resources which previously had only limited commercial access to export markets.

Shun-chin Chou has shown that railways such as the S.M.R. were indispensable to the development of mining in Manchuria and also facilitated the growth of the soya bean trade (Chou, 1971: 57-84). The extramural lines of the I.R.N.C., on the other hand, primarily served the agricultural sector. Although the I.R.N.C. did not provide separate returns for the intramural and extramural lines, a comparison of statistics for 1931 and 1932 provides some indication of the nature of trade on the respective sections. By 1931 total agricultural tonnage had reached 1,118,000 tons, compared to 674,000 tons in 1916. When the extramural lines were lost to Japan in 1932, agricultural tonnage dropped to only 466,000 tons. Average distance carried also declined from 305 kilometers to 100 kilometers. In contrast, tonnage for minerals and manufactured

goods remained stable. Clearly the extramural lines' freight consisted primarily of agricultural products carried for great distances (Ministry of Communications, 1917: 33).

Cheap overland transport coupled with the relaxation of barriers to Chinese immigration, signalled in part by the special rates offered by the I.R.N.C. to immigrants, created an ideal situation for economic development. Empty land was available at low cost and, it may be assumed, offered greater opportunities for increased production through additional inputs of labor. Not only did acreage under cultivation increase, but Manchuria produced abundant surpluses of cash crops, primarily soya beans, and grains such as wheat and kaoliang. The I.R.N.C. facilitated the shipment of Manchurian wheat to China proper and helped stimulate cotton production. By 1928, 15 million catties of cotton were being grown along the I.R.N.C. in Manchuria compared to 11 million catties along the S.M.R. (Mantetsu kogyobu nomuka, 1928: 37). Foreign trade, especially exports, continued to boom. Exports from Dairen rose from H. K. Tls. 12 million in 1908 to 121 million in 1921, the greatest increase of any port in China (IMC, 1912: Vol. II, 330-331; IMC, 1922: Vol. 2, 424-425).

It is an exaggeration to claim that railways were the decisive factor behind the growth of the Manchurian economy. Elimination of restrictions to Chinese immigration, the opening of ten ports to foreign trade after 1905 and large scale foreign investment also were important. There was a demand for Manchurian products and, in contrast to Hebei, output could be expanded for some time without a drastic reorganization of rural patterns. But by fulfilling the need for cheap transport, railways made possible a rapid response to the world market and permitted a fuller exploitation of Manchuria's natural resources.

As for northern Hebei, the I.R.N.C. provided only a limited stimulus for economic growth. Much of the region was reasonably well served by a river-canal system that was cumbersome but cheap. Most of the region was grain deficient and with the exception of the mineral deposits, chiefly coal, near Tangshan, it did not contain untapped resources requiring

cheap access to markets. Thus, the positive benefits of the railway were minimal.

INDUSTRIAL DEMAND AND BACKWARD LINKAGE EFFECTS

One striking characteristic of railway development in early twentieth-century China was its failure to generate backward linkage effects—demand for industrial inputs for the construction and operation of railways. In part this was a function of the relatively small size of the Chinese railway network, which in 1911 consisted of only 8,000 kilometers of track. The 1,444 kilometers of main track in Zhili [Chihli], the largest of any province, serviced an area of 59,000 square miles and a population in 1919 of 22 million (Ministry of Communications, 1917: Table I; Ministry of Communications, 1924: Table 1, and Part II, p. 4). Moreover, there was no appreciable increase in railway mileage after 1914, when World War I cut off the flow of foreign investment. In the following years the existing network deteriorated as the result of gross neglect by successive warlord governments and the ravages of civil war.

Still, some $700 million in capital investment were expended on Chinese railways between 1898 and 1916. Annual expenditures for operating expenses, maintenance and salaries for government railways in 1916 amounted to over $28 million.[3] In short, the railway was a major component of capital investment in China.

The extensive use of unskilled manual labor in the construction of railways is one reason why railways did not generate a greater demand. According to Fishlow's study of ante-bellum railways in the United States: "Expenditure for the preparation of the right of way dominated rail costs. In terms of total flow, they came to two-fifths. . . .These expenditures did not give rise to much more than employment of unskilled labor with picks and shovels" (Fishlow, 1965: 118). Similar techniques were used in preparing the right of way on the I.R.N.C. and other Chinese railways. Most of the work was performed by gangs of coolies using shovels and wicker baskets. The charges for such work were very low, ranging from 10 cents to 13.5 cents per

cubic yard (Stringer, 1922: 165; Kinder, 1891: 290). As late as 1922, despite substantial inflation, the engineers of the I.R.N.C. felt that excavating machinery was "out of the question as far as railway work is concerned" because coolie labor was cheaper and five times faster (Stringer, 1922: 165-166). In fact, the only power driven machines recommended were those needed for stone breaking and quarrying and a steam-driven circular saw.

However, the low cost of manual labor in China also meant that rolling stock and other finished products were a large component in the capital expenditure of Chinese railways. In Table 8 the capital expenditure of the state-owned railways is classified into labor and capital intensive components.

According to the Ministry of Communications, most of the expenditure for rolling stock, bridgework and track went for the purchase of material. If we include materials purchased by directly concessioned railways, which are not included in the statistics of the state system, close to $400 million was spent on capital goods by 1916. This figure probably overstates the amount purchased out of construction accounts, but it is more

TABLE 8
Components of Railway Construction, 1916
(thousands of dollars)

	I.R.N.C.	*National*
Labor Intensive		
Earthworks	2,445	27,733
General Expenses	6,018	45,305
Stations	4,737	27,475
Signal Switches	955	3,796
Land	1,431	18,063
Total (including misc.)	15,586	122,372
Capital Intensive		
Bridgework	10,308	64,021
Track	13,643	84,471
Central Mechanical Works	2,368	5,911
Plant	677	3,966
Rolling Stock	16,235	70,224
Total (including misc.)	43,211	228,593

SOURCE: Ministry of Communications, 1917: Table VIII.

than balanced by purchases of materials for maintenance and repair. In all likelihood an average of $20 million per year was spent on industrial products for railways between 1895 and 1916.

Although railway spending was a significant factor in capital expenditure during this period, only a small portion of the total went for Chinese products. According to the annual reports of the Imperial Maritime Customs, imported railway materials averaged well over H.K. Tls. 10 million, or approximately $14 million per year (see Table 9).

Imported railway material may have accounted for only 2.5% of total imports to China, but they absorbed 50% to 90% of capital expenditure on industrial goods for railway construction. This flood of imports was both a cause and a symptom of the problems confronting Chinese industry. Domestic capital was scarce and interest rates were an important cost in the iron and steel industry. The resulting high costs, compounded as they were by inefficiency and undercapitalization, left the Hanyeping Coal and Iron Company, China's sole producers of

TABLE 9
Imported Railway Materials
(in thousands of H.K. taels)

Year	*Iron rails*	*Rolling stock*	*Plant and Materials*
1903	16		7,996
1904	34		6,046
1905	589		7,346
1906	747		11,439
1907	230		12,804
1908	660		12,893
1909	2,070		13,107
1910	1,989		15,106
1911*	997	3,566	?
1912*	167	3,197	?
1913*	896	1,861	4,316
1914*	514	4,734	6,499

*After 1910 a different classification is used.
SOURCES: IMC, Returns of trade: Abstract of Foreign Trade, Foreign Goods: Net imports.

rails, in a weak competitive position vis-à-vis western imports (Feuerwerker, 1964: 91).

There is nothing surprising about this. The iron and steel industry in the United States entered the railway age as a well-established industry with a broad market for industrial goods autonomous of railways and with access to cheap money. Even with these advantages, the American iron and steel industry felt it essential to make railways into a captive market protected by a wall of tariffs. This path was not open to China. International restrictions on China's tariff autonomy precluded the adoption of protective tariffs essential to support infant industry. China was bound by treaty to limit tariffs to 5% valorem, a rate too low to discourage foreign imports. Nor did it have the right to prohibit imports of specific categories of goods. To make matters worse, foreign engineers frequently were prejudiced against Chinese products, either because they believed Chinese goods to be inferior or because they were employed by Western syndicates anxious to secure purchasing contracts. As Albert Feuerwerker has pointed out, China's inability to exclude competition or increase import taxes meant that a firm such as the Hanyeping was "obligated to sell at or below a market price that was often less than its costs of production" (Feuerwerker, 1964: 91).

The Tangshan workshops of the I.R.N.C. provide another illustration of the damaging impact of foreign competition and imperialism on backward linkages. Originally founded in 1889 as a repair facility, the shops gradually were expanded into a major center for the production of rolling stock. These facilities, which in 1916 accounted for 40% of all investment in central physical plant of the state railways, had the potential to become the nucleus of an indigenous locomotive and rolling stock industry. In addition to producing freight and passenger cars, the shops could turn out finished locomotives. At first the cars had been assembled from materials imported from abroad, but as the plant expanded it developed the capacity to cast most of the necessary parts. By 1908 the brass foundry could turn out 98 tons of specialized castings while the iron foundry had a capacity of 1,000 tons (Ministry of Communications,

1930: Jing-Feng tielu, 321-333; FO 228/2292, Financial Accounts of I.R.N.C. for 1908 and 1910).

Apparently the shops produced most of the I.R.N.C.'s rolling stock and did so at prices that offered substantial savings. However, the I.R.N.C.'s demand for rolling stock was quite uneven, as seen in Table 10.

After 1906 the Tangshan shops had considerable excess capacity. According to Claude Kinder, other Chinese railways were purchasing foreign products at prices higher than those asked by Tangshan because of jealousy between various railways and the influence of "interested" foreign advisors (FO 228/2492, Doc. 53). As a result of the preference for foreign goods, many of which were inferior in quality to the Tangshan products, the reduced volume of business increased overhead costs per unit. This in turn led the directors to increase prices on goods sold to other railways. By 1909 the workshops were unwilling, or else unable, to sell at prices that were competitive with Western imports. The situation improved slightly when the Ministry of Posts and Communications applied pressure on other Chinese railways to buy from the Tangshan shops. In 1910, the workshops were producing 56 cars for use by the I.R.N.C. and 287 cars for other lines (FO 228/2292, Financial Accounts for 1910).

TABLE 10
Annual Production of Freight and Passenger Cars
(probably for use on the I.R.N.C.)

Year	*Number*	*Year*	*Number*
1900	299	1909	114
1902	366	1910	63
1903	35	1911	84
1904	162	1912	125
1905	280	1913	36
1906	375	1914	266
1907	185	1915	136
1908	161	1916	11

SOURCE: Ministry of Communications, 1930: Jing-Feng tielu, 321-333.

Despite these technical accomplishments the workshops never became the primary producer of rolling stock for Chinese railways. Moreover, the general weakness of the Chinese metallurgical industry meant continued dependence on foreign sources of supplies. The outbreak of World War I shut off the I.R.N.C.'s access to wheels and axles. Since the Chinese steel industry was unable to manufacture these specialized parts, production of rolling stock plummeted. In 1918, when the I.R.N.C. was short of an estimated 30 locomotives and 700 freight cars and the Kaiping Mines could not increase production because of transportation bottlenecks, the workshops turned out only seven cars (FO 228/2797, No. 1, Ker to Jordan, Dec. 31, 1917).

Neither the steel nor the metallurgical industry, the most likely beneficiaries of railway-induced demand, was able to capitalize on the construction of Chinese railways. Foreign imports, unchecked by a protective tariff or other measures designed to reduce the advantages enjoyed by imports, captured most of the market. The coal industry also was only a marginal beneficiary of railway-induced demand. The I.R.N.C. consumed 120,000 tons per annum, but this represented less than 9% of the total output of its main supplier, the Kaiping Coal Mines. While this was not inconsequential, the development of markets in Shanghai and abroad was of greater importance. The main contribution of the railway to the coal industry came in the form of cheaper transportation, not demand.

CONCLUSIONS

Countries characterized by low levels of capital accumulation and a market mechanism that is not geared towards modern economic growth may require positive government intervention to restructure the socioeconomic environment. This can be accomplished by a planned economy with the government assuming direct responsibility for key industries, by fiscal manipulation and public assistance to critical sectors of the economy, or by otherwise compelling the private sector to alter

old patterns of consumption and investment. Without some such measures it may be impossible to start key industries, especially those that are capital intensive.

Late Qing planners were confronted by a failing central government which no longer could dictate policy and a private sector incapable of financing a full program of modernization. Within these limitations they sought to fashion a policy that would fuse state capitalism, foreign assistance, and private enterprise into a coherent program of economic development. In addition to some limited institutional reforms, such as the promulgation of a commercial code and authorization of chambers of commerce, intended to increase merchant entrepreneurship, the government gave a very high priority to the development of a national railway system. The external economies of improved overland transportation and the demand generated by railway construction would, they believed, stimulate growth in all sectors of the economy.

But China could not build a national railway system relying only on its own resources. The private sector did not possess an abundance of risk capital or a modern banking and financial system capable of mobilizing large sums of money. The nature of railway investment—immobilization of enormous sums that are likely to earn only modest rates of return and have limited liquidity—made it almost impossible for railways to compete with other sectors of the economy for capital. Moreover, the central government lacked the political leverage to raise the requisite funds from the provinces and countryside. Success for such a program under any leadership would have required at the very least a government in full control of the country and strongly supported by the articulate elements of the population. These conditions did not exist during the late Qing. The crushing burden of foreign indemnities and the needs of other modernization projects dealt a final blow to hopes for a domestically financed railway system. Foreign loans thus were essential to compensate for the lack of risk capital and to replace money paid out in the form of indemnities.

The history of the I.R.N.C. partially supports the Ministry of Posts and Communications' contention that a carefully drafted

policy of foreign railway loans was not necessarily detrimental to China. The I.R.N.C. was well planned, earned excellent profits and, with the exception of the period 1898-1903, its loan agreement did not entail serious restrictions of Chinese sovereignty. The rise of Chinese nationalism, coupled with post-1903 reforms, enabled China to eliminate the most restrictive provisions of the loan agreement and place the foreign staff under de facto Chinese control. By 1909 profits from the I.R.N.C., and the Peking-Hankow Railway, made it possible for the state railway system to earn close to 10% on investment, a sum sufficient to cover interest and amortization charges on foreign loans. Portions of the remaining surplus were utilized to finance new construction such as the Peking-Suiyuan Railway. When applied to the purpose for which they were intended, foreign railway loans did not always pose an insurmountable obstacle to efficient management and Chinese control.

This does not mean that imperialism in the broad sense of the term did not have a pernicious influence on Chinese railway development. The I.R.N.C. was a financial success because it possessed a favorable route and because the foreign staff, generally responsive to Chinese needs, adapted operational procedures to the Chinese environment. Most likely the attitude of the foreign staff was the exception rather than the rule among foreign-financed railways. Yet even the I.R.N.C. was hampered in its operations by the legacy of the scramble for concessions. The most obvious examples were its virtual exclusion from the carrying trade of Manchuria and the difficulty of securing cooperation with other lines of the Chinese state system. Of lesser importance to the I.R.N.C. but of great significance to the local economy was the need to maintain artificially high freight rates and to refrain from adventurous risk-taking, both of which were directly related to fears of default to foreign creditors.

Other foreign-financed railways of the state system, with the exception of the Peking-Hankow Railway, were much less successful. Undoubtedly competition from water routes and

other factors unrelated to foreign influence were important. Nonetheless, it is clear that foreign engineers on lines such as the Tientsin-Pukou and Shanghai-Nanking railways spent money lavishly and without due regard for future returns. Maintenance of separate administrative and physical entities—required by most of the loan agreements—added to operating expenses at a time when the state system still was struggling to break even.

As for the impact of railways on economic development, Qing planners had assumed that railways could by themselves alter the environment in favor of modern economic growth. This ignored the inherent limitations of railway innovation as well as the obstacles to industrialization and agricultural innovation in China.

First, it is sometimes assumed that railways historically have served as the leading sector for economic development in the United States and Western Europe. However, the veracity of such a generalization is open to question. In Britain, France, and the United States railways were not only a force for industrialization, they also were a manifestation of the forces producing industrialization. The railway era had been preceded by decades of intensive development of canals and toll roads, a fact that indicated a strong demand for improved communications and an economy that could afford to finance railways and respond to opportunities opened by railways. Industries such as iron and steel, which benefited from railway-induced demand, already had a strong foundation in a broadly based market. As Fishlow's study of ante-bellum railways in the United States demonstrates, the primary beneficiary of railway development was agriculture in the recently settled midwestern states, not industry. On the basis of his finding, Fishlow cautions against optimistic assessments of the potential of railways: "The ability of an infrastructure to alter the economic environment in favor of industrialization is perhaps weaker than we appreciate" (Fishlow, 1965: 306).

Second, the inherent limitations of railway innovation were compounded when introduced into a country such as China, which was relatively developed and open to foreign competi-

tion. Despite extravagant expectations, the I.R.N.C. did not substantially reduce the overall cost of transportation in northern Hebei. The river-canal system of the region was reasonably competitive in price, the volume of long-distance interregional trade was limited and the absence of cheap transport to and from rail centers further minimized the impact. Railways made a valuable contribution in Manchuria (and probably the region served by the Peking-Hankow Railway, which was more dependent on overland transportation). In much of southern and central China, where water transport was cheaper and more efficient than in the north, railway development could not have significantly reduced transport costs.

Not only were the savings resulting from railway innovation small, but the highly developed state of Chinese agriculture and handicrafts meant that most exploitable resources already were being utilized. There were important exceptions—the coal industry and vast tracts of land in Manchuria and Inner Mongolia. But the Chinese economy was not one in which abundant resources were left untapped because they did not have cheap access of markets.

Third, the lack of tariff protection and the constant threat of foreign competition made it all the more difficult for the limited stimulus from railway development to influence industrial development. Between 50% and 90% of all industrial purchases for railway construction in China were made abroad, thereby eliminating any significant backward linkage effects. Although the connection is less direct, it seems logical to assume that forward linkage effects in the industrial sector also were minimized by unrestrained foreign competition. Cheaper energy and transportation costs could not compensate for the other advantages enjoyed by foreign manufacturers.

Fourth, agricultural stagnation lay at the heart of China's economic problems. It reduced the rate of capital accumulation to a point where a high percentage of the rural population could not afford to finance technological improvements in agricultural production. Again, this was not something that could be altered by a slight reduction in transportation costs. More could have

been done to enhance the potential of railways by concurrently developing an adequate system of local roads, abolishing likin and reducing freight rates. However, it is dubious whether this would have been sufficient to revolutionize agriculture. In all likelihood, agricultural modernization required government action to deal with such root problems as the maldistribution of land, lack of rural credit, existing patterns of consumption, and the like. These were measures which touched the very heart of gentry power; no government prior to 1949 was in a position to act.

In short, railway development and improved transport may only be a precondition for economic growth. As Singer (1956: 290) has noted, "The creation of these external economies is not only fruitless in the sense that it is merely a precondition, albeit an essential one, of useful production; it also implies activities of a peculiarly high capital intensity." Late Qing planners turned to railway development to break the vicious cycle of underdevelopment because they had an exaggerated opinion of the linkage effects of railways and because they were aware of the limitations of government power. Ironically, the availability of foreign capital and the successes of the late Qing rights-recovery movement may have contributed to Peking's failure to consider more drastic steps. Despite the abysmal failure of most provincial campaigns to raise domestic capital for railways, their determination to exclude foreign capital nevertheless forced them to contemplate programs of forced savings. Peking was content to accept foreign largesse and assume, on the other hand, that railways once built would create the necessary conditions for future growth.

The modernization of the totality of Chinese society was an unrealistic conception for the late Qing because of its internal weakness. Industrial growth without internal reform and the recovery of tariff sovereignty was impractical. In Japan and Germany, the prime examples of industrialization in the late nineteenth century, powerful central governments took the lead in creating institutions supportive of modern growth: investment banks, the abolition of feudalism and serfdom, agricul-

tural extension programs, and the like. According to Henry Rosovsky, much of the credit for Japan's economic growth must be attributed to government leadership in "socioeconomic and institutional reforms and the creation of a modern financial banking system" (Rosovsky, 1966: 91-139).

China, on the other hand, could do nothing in these fields nor could the weak Qing government establish protective tariffs to assist infant industry. As a result the Chinese experience in railway development confirms the conclusions reached by Rondo Cameron in his study of French foreign investment in Europe: "when it went to areas with traditional or reactionary political and social regimes, as in the cases of Iberian and Balkan railways, its contribution was slight" (Cameron, 1961: 507).

NOTES

1. The I.R.N.C. ran from Peking to Mukden with a branch line connecting Yingkow to the main line at Goubangzi. It also is known as the Peking-Mukden Railway (Jing-Feng Tielu or Bei-Ning Tielu in Chinese). The term "intramural lines" refers to those sections south of the Great Wall at Shanhaiguan; "extramural lines" include the Shanhaiguan-Mukden section plus the Yingkow extension.

2. The standard financial unit in this chart and throughout the text is the Chinese dollar

3. According to the Ministry of Communications, $413 million had been invested in the 5,071 kilometers of main line owned and operated by the Chinese government in 1916. This figure excludes another 3,300 kilometers classified as "direction concessioned railways" (that is, lines leased to foreign governments or semi-official companies and under their direct management) Assuming that the concessioned railways were as costly as those operated by the Chinese, total expenditure would approximate $650 million to $700 million (Ministry of Communications, 1917, Table 1 for capital expenditure on the state system; Ministry of Communications, 1924, Table 1, plus Part II, p 4, for mileage of concessioned railways)

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