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China's Telecommunications Infrastructure Buildup
On Its Own Way

Ding Lu

In many aspects of its market-oriented reform, China has been moving forward on its own way. The regime's gradualist, trial-and-error reform defies the big bang approach recommended by some Western gurus for transitional economies. Nevertheless, the Chinese economy has proudly displayed spectacular growth and rising living standards, in sharp contrast to the painful transition in the Eastern European and the former Soviet states. Between 1978 and 1995, China's economy chalked up an average annual real growth rate of 9.7 percent. The economy grew at double-digit rates for four consecutive years from 1992 to 1995.

The uniqueness of the Chinese experience is equally, if not more, impressive in the country's telecommunications industry. Opening of telecommunications markets and privatization of telecommunications services have become worldwide trends as technological progress redefines the nature of the industry. China's telecommunications sector, however, remains centrally planned, state-owned, and monopolistic in major service areas. Unlike most other Chinese sectors, the telecommunications sector still shuts its door to direct foreign equity investment and foreign operation of businesses. The hierarchical business empire under the Ministry of Posts and Telecommunications (MPT) still maintains an old-style tariff structure based on redistribution and cross-subsidization. The emergence of non-MPT domestic (also state-owned) carriers, although challenging, has not posed a serious threat to the MPT's monopolistic hold on the industry.

Despite all these apparent shortcomings, China's telecommunications

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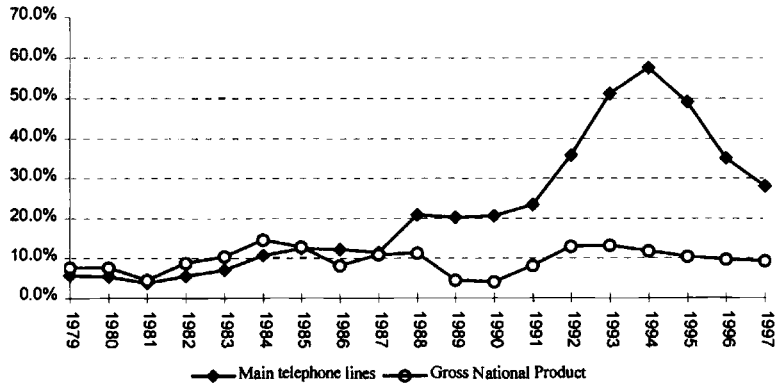

Fig. 13.1 Growth rates of GDP and main telephone lines
Sources: China Statistical Yearbook (various years) and *Yearbook* (various years).

infrastructure has been growing at an astonishing rate. Figure 13.1 shows that there has been a sudden speed-up in telecommunications infrastructure development since the late 1980s. From 1991 to 1995, China installed more than 73 million phone lines, more than all the rest of the developing world combined. This has made China one of the largest telecommunications networks in the world. In the past decade, the growth of the telecommunications business has dwarfed the nation's already spectacular GDP growth by a four-to-one margin. The telephone penetration rate (measured by number of telephone terminals per 100 persons) rose sharply from 0.6 to 4.66 in a decade (fig. 13.2). In urban areas, the rate reached 17 percent by 1995. Many coastal cities, in particular, raised their telephone penetration level from 2 to 3 percent to above 30 percent by 1995, in less than a decade's time.[1]

Compared to other developing countries, to what extent has China been an overachiever in building up its telecommunications infrastructure? How did China manage to develop its telecommunications infrastructure in leaps and hops while maintaining a centrally planned and monopolistic regime? Has China achieved this in an efficient way? This paper tackles these questions. Section 13.1 contrasts China's telecommunications statistics with those of other developing countries. Section 13.2 discusses the incentive structure facing Chinese telecommunications enterprises. Section 13.3 examines government policies to mobilize capital and encourage telecommunications investment. In section 13.4 I comment on the efficiency of China's investment in telecommunications and try to identify

1. The statistics in this paper, if not otherwise noted, are from *Yearbook of China Transportation and Communications*, hereafter *Yearbook* (various years).

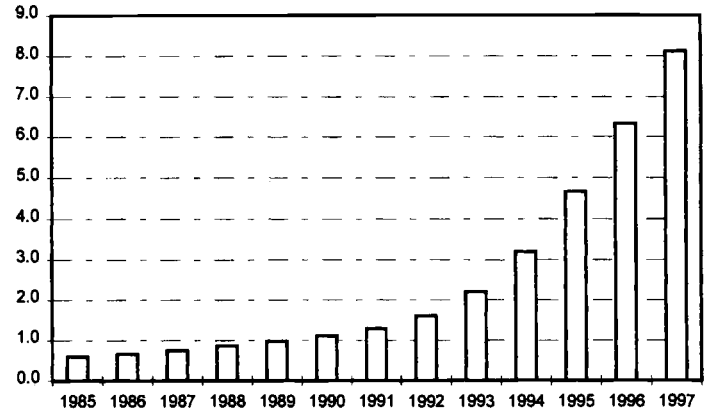

Fig. 13.2 Telephone terminals per 100 residents
Source: Yearbook (various years).

the factors at work. In the concluding section I speculate about the impact of the development experience on Beijing's future industrial and trade policy toward domestic and foreign competition, in particular, its stance on issues related to China's World Trade Organization membership.

13.1 A Leap Forward in Infrastructure Buildup

The current phase of hyper economic growth in China started around the end of the 1970s when the country embarked on market-oriented reform. In 1982, Beijing announced an ambitious plan to modernize the economy and quadruple the nation's annual gross output within two decades, by the year 2000. Concerned about the economy's weakness in infrastructure and technology, this plan highlighted three "strategic foci" for development. One was energy and transportation, the second was agriculture, and the third was education and science. Economic reform was instrumental in raising efficiency and restructuring the economy for further growth (*Documents* 1982).

Like other infrastructure services, telecommunications was one of the worst bottlenecks in the economy when the aforementioned plan was launched. The Centre for Economic and Technological Development of the MPT did research based on econometric modeling showing that the marginal contribution to the national economy brought by adding one dollar of investment in information resources was 15.8 times that brought by investment in physical resources (Yang 1991). The center used data from twenty-nine countries to regress telephone line density on factors such as per capita GNP, average educational level, and relative size of

Table 13.1 **Telecommunications Infrastructure: Targets Hit**

Sixth Five-Year Plan: 1981–85	Planned for 1985	Achieved by 1985
Urban switchboard capacity (lines)	2.7 million	3.37 million
Long-distance phone lines	28,011	37,551
Telephone terminals per 100 residents (up from 0.43 in 1980)	n.a.	0.6
Average annual growth rate of postal and telecommunications turnover (%)	5.0	9.8
Seventh Five-Year Plan: 1986–90	**Planned for 1990**	**Achieved by 1990**
Urban switchboard capacity (lines)	6.35 million	8.26 million
Long-distance phone lines	109,615	112,437
Telephone terminals per 100 residents	n.a.	1.11
Average annual growth rate of postal and telecommunications turnover (%)	11.05	22.5
Eighth Five-Year Plan: 1991–95	**Planned for 1995**	**Achieved by 1995**
Urban switchboard capacity (lines)	18 million	54.56 million
Long-distance phone lines	350,000	735,545
Telephone terminals per 100 residents	Above 2.0	4.66
Average annual growth rate of postal and telecommunications turnover (%)	20	35.1

Sources: China Statistical Yearbook (various years), *Yearbook* (various years), MPT Planning Department (1987, 1993, 1996), and Liu S. (1992).

service industries. The regression result was compared with China's relevant data, and it was concluded that only half of the social demand for telecommunications was met in the 1980s.

To safeguard the national economic plan, the MPT in 1983 proposed to increase the number of telephone terminals tenfold by the year 2000. Meanwhile the telephone penetration rate was to reach 2.8 percent by the turn of the century (*Almanac of China's tertiary industry* 1993, 543).

With comfortable margins, the MPT successfully reached the targets set in the Sixth Five-Year Plan, for 1981–85 (see table 13.1). Compared to earlier decades, the growth of telecommunications infrastructure in this period was unprecedented. Increased fixed capital in these five years amounted to Rmb 4.2 billion, equivalent to two-thirds of the total increased fixed capital in the three decades from 1949 to 1980.[2] The investment generated 1.37 million lines of urban switchboard capacity, compared to a total increase of 1.69 million lines from the 1950s to the 1970s.

2. The official exchange rate in 1990 was US$1.00 = Rmb 4.78. After the Chinese currency (yuan or renminbi) was made partially convertible in 1994, the exchange rate was about US$1.00 = Rmb 8.6. Since then the Chinese currency has gradually appreciated against the U.S. dollar. As of 30 April 1997, the exchange rate was about US$1.00 = Rmb 8.29.

Notwithstanding that, growth of the telecommunications sector failed to beat overall economic growth during the first half of the 1980s (fig. 13.1).

Telecommunications infrastructure development sped up in the mid-1980s after the government introduced stimuli into the industry (see section 13.2 for details). The growth rate of main telephone lines was twice the rate of GDP growth from 1988 to 1991 and rose to above 30 percent after 1992.

Table 13.1 shows that the telecommunications sector has developed much faster than was planned by China's central planners. Again and again the explosive growth of the industry has turned government blueprints into poor forecasts. Take switchboard capacity, for example. For the Sixth Five-Year Plan, capacity built was 25 percent higher than what was planned. During the Seventh Plan period, the target was overshot by 30 percent. In 1995 capacity reached a level 200 percent higher than specified in the Eighth Plan!

With such astonishing growth, China has effectively caught up with the rest of the world in telecommunications infrastructure buildup. To evaluate this effect, we statistically estimated the correspondence between teledensity (defined as main telephone lines per 100 residents) and GNP per capita (see appendix B for details of the modeling) for low-income and middle-income countries. We then used the estimated models to forecast China's teledensity levels corresponding to the country's per capita GNP for the years 1987 and 1994. In 1987, China had a per capita GNP of US$290 and a teledensity figure of 0.3741, which was about 17 percent higher than its forecast level (0.3202). By 1994, however, with a per capita GNP of $530, China had reached a teledensity level of 2.2865, about 53 percent higher than the forecast level (table 13.2). The implication is that in 1987 China had a telecommunications infrastructure compatible with its income level. By 1994 the country had become more developed in telecommunications than in income level.

The figures in table 13.3 also show that China has become an overachiever among low-income countries in developing telecommunications infrastructure. The gap between China and the middle-income countries in teledensity is quickly being closed. Between 1984 and 1994, the quantity of China's main telephone lines grew at a compound annual rate of 25.7

Table 13.2 **China's Forecast Teledensity Compared with Actual Teledensity**

	1987	1994
Per capita GNP (US$)	290	530
Forecast teledensity	0.3202	1.4974
Actual teledensity	0.3741	2.2865
Gap (forecast compared to actual)	16.83% higher	52.70% higher

Source: Appendix B.

Table 13.3 Catching Up in Teledensity

Country	Teledensity	Compared to China's Teledensity
1987		
China	0.3741	
Low-income country average	0.2911	22.2% lower
Middle-income country average	5.2724	13.3 times higher
1994		
China	2.2865	
Low-income country average	1.6040	29.8% lower
Middle-income country average	13.4885	4.9 times higher

Sources: Yearbook (1991, 1996) and ITU (1995a).

Note: According to the World Bank classification, countries with per capita GNP below US$500 in 1987 or with per capita GNP below US$750 in 1994 are low-income countries. The per capita GNP range for middle-income countries is US$500–$6,000 for the year 1987, while the range is US$750–$8,500 for the year 1994.

percent, the highest in the world (ITU 1995b). In comparison, the average growth rate for low-income countries was 17.4 percent, and the world average was 5.2 percent. In 1995, China's main telephone lines increased by another 49 percent. While China's population increased almost 13 million in that year, the country's teledensity rose from 2.2865 to 3.3607 lines per 100 residents.

13.2 Incentives Inside the State Monopoly

China's telecommunications sector took off with a series of fundamental institutional changes and strong centrally planned initiatives during the 1980s and early 1990s. These developments fundamentally changed the incentive structure of telecommunications enterprises and their business environment.

In the Mao era (the 1950s to the 1970s), the telecommunications infrastructure received low priority in the heavy-industry-oriented development plans. The telecommunications sector was seen purely as a tool to serve administrative needs. Its "nonprofit feature" was reflected in the fact that the state-owned monopoly was in the red eight out of ten years in the 1970s (fig. 13.3). Telecommunications expenses were classified as "nonproductive" and often subject to cuts during hard times. Subscribing to a residential telephone line used to be an exclusive political privilege reserved for high-ranking officials. The state-owned telecommunications system was semimilitary and had a rigid administrative structure (Yang 1991; Gao 1991).

When China started its economic modernization program in the late 1970s, the telecommunications sector was a visible bottleneck in the econ-

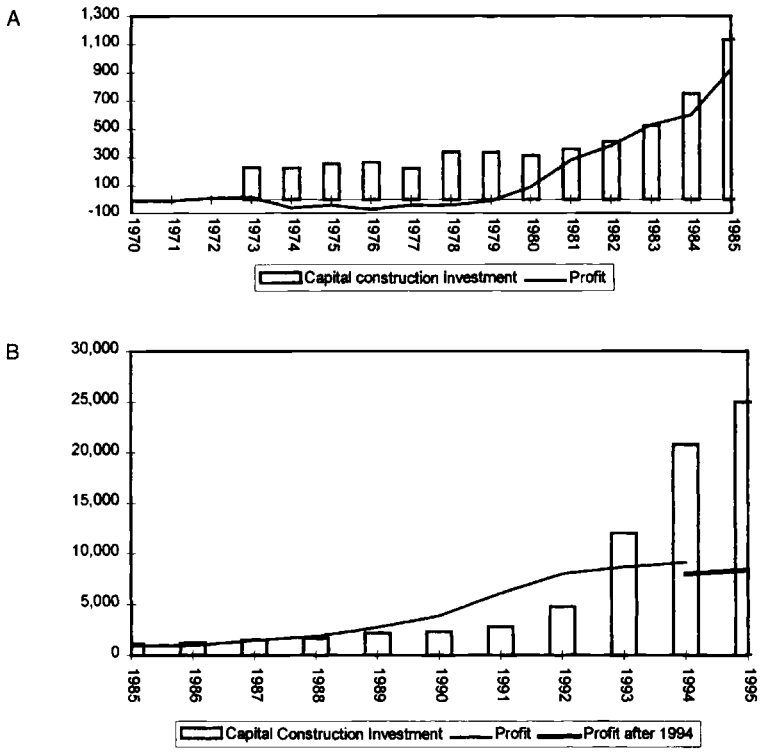

Fig. 13.3 Capital construction investment and profit of postal and telecommunications enterprises, 1970–85 (*A*) and 1985–95 (*B*)
Sources: *China Statistical Yearbook* (various years) and *Yearbook* (1996).
Note: "Profit" refers to pretax profit. The 1994 tax reform changed sales-related taxes.

omy. This caused serious concern to policymakers. In an instruction issued in 1984, the State Council acknowledged that the sector was "seriously backward" and there existed a "remarkable gap between supply and demand" (*Yearbook* 1986, 243). The government introduced a series of reforms to rectify the problem starting in the late 1970s.

13.2.1 Organizational Revamp

The first step was to restructure the formerly semimilitary administration in the MPT system. The Ministry of Posts and Telecommunications is the functional organ of the State Council responsible for nationwide postal and telecommunications services. The prereform system was highly centralized with little autonomy and financial accountability at the local enterprise level. All enterprise revenues were handed over to the authorities along the administrative hierarchy. Expenses were claimed from higher authorities in the hierarchy. The MPT centrally allocated nationwide in-

vestment. During the chaotic Cultural Revolution (1966–76), the MPT was dissolved in 1969 and the telecommunications sector was put under the regional military administrations. When the MPT was restored in 1973, it was not able to immediately regain centralized control of the national postal and telecommunications network. From 1973 to 1979, the governments at the levels of province, municipality, and prefecture had actual control over the planning for the postal and telecommunications business in their domains. This fragmented administrative structure caused many coordination problems in the industry (MPT 1986, 342).

In 1979, the State Council issued a directive to make the MPT the dominant central planner of nationwide postal and telecommunications development. Local postal and telecommunications enterprises (PTEs) were put under the "dual leadership" of provincial governments and the MPT, with the latter the main decision maker. Meanwhile, administration of daily business operations was to be decentralized with the introduction of primary financial accountability at the local level. As stipulated by the directive, in this sector government administration and business management should be separated. The postal business and the telecommunications business should also be separately administered. Enterprises should have their own accounts and should be made financially independent.[3]

In line with the above principles, local postal and telecommunications administrations (PTAs) were set up at the provincial level under the dual leadership of the MPT and the provincial governments. From 1983 to 1985, the MPT introduced a new accounting system, known as "enterprise own revenue," to define an elaborate methodology for calculating the income of an individual PTE (Guo and Xu 1992; Xu 1996). By the mid-1980s, all the PTEs had built their independent accounts and started to operate on a system of contractual responsibility in which their earnings were linked to their business performance.[4]

Since then, the administrative structure of China's telecommunications sector has been basically a vertically organized hierarchy. The national ministry at the top is responsible for overall planning and management of the industry. It controls international and interprovincial communications. It also sets and enforces technical standards and formulates key policies and plans. At the provincial level, the PTAs perform a similar role within the province. Below them are hundreds of municipal and prefecture postal and telecommunications bureaus (PTBs). Next, more than 2,000 county-

3. In Chinese: "Zheng qi fen kai, you dian fen ying, qiye hesuan, zi ji ying kui" (Gao 1991).

4. The accounting system for long-distance service commenced in 1985 with a simple record of the firm's long-distance revenue and operation costs. Since telecommunications service is a two-way exchange, the increase of real business revenue at one location may not necessarily reflect the growth of service quantity provided by the firm at that location. Therefore, the system was adjusted and improved in 1988 on a concept of network revenue (Lu 1994).

level PTEs operate local service networks in the county capitals and extend lines into the surrounding rural areas. Below them are tens of thousands of branch offices operating exchanges at the village level. There are also many private branch exchanges (PBXs) owned and operated by work units and rural villages (Mueller and Tan 1997).

The MPT system underwent a deeper revamp in 1988 amid a major state enterprise reform initiative taking place nationwide (Mueller and Tan 1997). Beijing announced the "sixteen-character policy" for telecommunications infrastructure development. The policy was summarized by sixteen Chinese characters,[5] which outline four principles:

Overall planning of industrial development should be unified under the MPT.
Ministerial administration should be coordinated with regional authorities.
Responsibilities should be defined and shared among different administrative levels.
Construction of infrastructure should mobilize resources from all concerned.

Following these principles, the MPT granted its national manufacturing, construction, and purchasing departments the status of separate legal entities or greater independence in financial accounting and human resource management. Meanwhile the MPT set up the Directorate General of Telecommunications (DGT) and the Directorate General of Posts (DGP) to incorporate business enterprise functions. The DGT is now known as China Telecom, which comprises twenty-nine provincial PTAs, all of which offer local and long-distance services. The PTAs in Beijing, Shanghai, and Guangdong also offer international services. The MPT itself handles regulatory matters through its Department of Policy and Regulation. Its other governmental functions were distributed among its Telecommunications Administration Department, the Department of Science and Technology, and the Department of Finance.

This was an important step toward complete separation between government administration and business management in the industry. In most areas, however, the local PTB is a combined government branch and business company. Until recent years, at the city and county level the local PTBs in some provinces did not even have business licenses, not to mention the status of legal persons. The definition of "enterprise" used to be very blurred in the postal and telecommunications industries (Xiao 1992). In 1995, the MPT's China Telecom formally registered with the government for the first time as an enterprise legal person (*Yearbook* 1996, 234).

5. In Chinese: "Tong chou guihua, tiao kuai jiehe, fen ceng fu ze, lianhe jianshe."

Nowadays most PTEs are still in the process of "corporatization" to restructure themselves into independent accounting entities that conform with China's Corporation Law (Li 1996).

13.2.2 Financial Stimuli

In parallel with organizational reforms, various financial stimuli came to promote infrastructure development and industrial performance. Traditionally, the MPT centrally controlled the pricing of most services, which included monthly rent and communications charges. The tariff policy before the 1980s was to underprice telephone services. Upward adjustment of rates was rare. Due to the underpriced rates, before 1980 the postal and telecommunications sector was in the red for more than ten years.

In October 1984, the State Council stipulated a "six-point instruction" to give priority to postal and telecommunications development. In this document, the government gave the green light to the MPT to adjust its service rates (State Council 1986, 243). During the period 1986–90, the MPT made adjustments to a wide range of telecommunications service rates. Consequently, the rate of capital return in the industry increased from 9 percent in 1986 to 17 percent in 1990, somewhat higher than the average rate of capital return for all industries. According to the World Bank, the rate of return of China's telecommunications industry in 1989, adjusted for accounting differentials, was equivalent to 12 percent by Western business standards (Ma 1992). Under the existing price structure, the rate of return is lower for local (intracity) services and higher for long-distance and international services.[6] At the end of 1990, intracity telephone rates were widely adjusted. The ministry set a price cap according to local telephone companies' average costs with a markup for profit. Local telecommunications companies were authorized to set their own intracity rates not exceeding the cap, subject to the approval of the local government's price control authorities (Sun 1992).

A pivotal stimulus for building up telecommunications infrastructure at the local level was the authorization of local telephone companies to determine and charge cost-based line installation fees. In 1980, the central government authorized PTAs to collect installation fees within ranges set by the MPT. For commercial phone lines, the installation fee ranged between Rmb 1,000 and Rmb 2,000 per terminal. For residential users, the charge was between Rmb 300 and Rmb 500 (Ministry of Finance 1986, 344–45). In 1990, the MPT adjusted its guidelines for telephone installation fees. The installation fee charges have since then been based on line

6. An MPT source disclosed that in 1993 the profit margin on local service was only 2 to 3 percent, while the margin on long-distance calls was 25 percent and on international calls 75 percent (Mueller and Tan 1997, 41).

connection costs. The decision making regarding installation charges has been decentralized to the local level. In the early 1990s, the installation charges varied from around Rmb 2,000 to more than Rmb 5,000 per line (Wu 1992). In comparison, the average annual wage in China was only Rmb 2,140 in 1990.

Along with the above fee adjustments, the management of moneys collected was organized in a system of "special funding accounts." The source (credit) side of these accounts consists of "earmarked grants" from the government and "specialized funds," which are collected by the enterprises themselves. The proportion of government grants in postal and telecommunications investment declined sharply from 59 percent in 1980 to 29 percent in 1981. It continued to drop, reaching 10 percent in 1989. The use (liability) side of these accounts divides funds into specialized purposes such as line maintenance and upgrading, new technology development, and local telephone line construction and connection. The system ensured that the funds collected (such as installation fees) were used solely for their earmarked purposes (such as line construction; *Yearbook* 1990, 270–71).

As for service operation, the accounting reform in the mid-1980s provided the basis to contract performance responsibilities to enterprise managers and employees. A PTE's own revenue is accounted as

$$EOR = \sum P_i Q_i \cdot \beta + \Delta R \cdot \gamma + LR,$$

where EOR is enterprise own revenue, Q_i is the firm's ith (interregional) service output, P_i is the unified national accounting rate, β is the regional cost coefficient, and LR refers to local (intracity) telephone revenue and other miscellaneous income. The item ΔR is the increased operating revenue over the previous year's basis. The item γ is a uniform "retaining ratio," which was set at 20 percent in 1989 (MPT 1989a, 617). The retaining ratio acts as an extra factor to encourage the enterprise to increase revenues.

In the early 1990s, the accounting rate was calculated according to 1987's average cost and profit tax rate in the industry. A catalog issued by the MPT lists the accounting rates of more than 140 service products. The regional cost coefficient β was estimated by regressing thirty-two provincial telecommunications companies' real costs against seven factors such as per capita income, weather conditions, telecommunications infrastructure investment, and the like (Zhang 1991). Net contributing PTEs have a coefficient $\beta < 1$ while the net receiving PTBs have a $\beta > 1$.

Based on the above formula, the ministry contracted performance responsibilities to the local PTEs. By 1995, most PTEs had completed three contracting periods, namely, 1985–88, 1989–91, and 1992–95. The more recent contracts included supplementary evaluative criteria such as communications quality and capital investment. Beginning in 1991, some con-

tracts have included terms of "asset responsibility," which define managers' responsibility for maintaining and improving the state assets in their charge (Liu Z. 1992).

An important incentive incorporated in these contracts was to link PTBs wage fund increases to their service output increases. Starting in 1988, PTBs' wage fund increases were calculated as

$$\Delta W = s(0.5 \cdot G + 0.5 \cdot g) \cdot W,$$

where g is the PTB service quantity growth rate, G is the MPT service quantity growth rate, W is the previous year's total wage, and s is a "floating ratio coefficient," which is 0.7 for each PTB and 0.8 for all PTBs (MPT 1989b, 614–15). The weight of PTB service quantity growth increased to 60 percent in 1993 and further increased to 70 percent in 1994. The rationale for this arrangement is that the local company's service not only contributes to its own revenue but also to the revenue of the entire network. In 1994, all quantity growth rates in the formula were replaced by revenue growth rates (*Yearbook* 1995, 247).

How much employees and managers can actually get paid from the wage fund depends on evaluation of four aspects of performance with different weights of marking: communications quality (40 marks), communications quantity (20 marks), profit level (20 marks), and labor productivity (20 marks). If, for instance, the total evaluation is below 85 marks, 1 percent will be deducted from the wage fund increase. If communications quantity increases 5 to 10 percent over the previous year, the wage fund will get an additional percentage point of increase. In 1994, some other factors, including asset value and wage-profit ratio, were added to the marking in order to encourage greater efficiency.

13.2.3 Privileged Status

To facilitate telecommunications development, a policy of "three 90 percent" was developed upon the State Council's "six-point instruction" of 1984 (Gao 1991; Wu and Zhang 1992). According to this policy:

Ninety percent of profit was to be retained by the MPT (in other words, the tax rate is 10 percent, well below the 55 percent tax rate for other industries).

Ninety percent of foreign exchange (hard currency) earnings were to be retained by the MPT.

Ninety percent of central government investment was not considered as repayable loans.

In addition, PTEs and PTBs might also enjoy favorable interest rates when they got loans from state banks (Luo 1992).

In 1994, China introduced a major tax reform aiming to unify corporate tax rates into an across-the-board 33 percent rate for all enterprises and to

simplify the tax levy structure. Meanwhile, after a reform to unify foreign exchange rates and make Chinese currency convertible for current account transactions, enterprises benefit little from retaining their foreign exchange earnings. The preferential "three 90 percent" policy has since no longer been relevant (Luo 1996).

In summary, after delegation of greater management autonomy, the PTEs face an incentive structure that strongly encourages business expansion. All revenues from local (intracity) telephone services are kept by the PTEs. Their revenues from (interregional) services are determined by unified national accounting rates and a regional cost coefficient. On top of that, the PTB retains 20 percent of the increased operating revenue over the previous year's basis. For PTB employees and managers, the effective way to increase their wage fund is to increase the output or revenue of the enterprise and of the MPT's national network by generating more telecommunications traffic. Until some changes in 1995, the other factors of performance evaluation played only a secondary role in wage determination. Therefore, there have been strong incentives for output and revenue maximization.

When service prices and tariffs for long-distance telecommunications are set by the MPT and local rates and installation charges are capped, revenue maximization is equivalent to output maximization. Therefore, the PTEs must increase revenue by expanding quantity of sales. Given the low teledensity, strong and growing demand, and infrastructure bottleneck, China's telecommunications market has been a supply-constrained one until recently. The PTEs have no alternative but to make all-out efforts to increase their supply capacity by improving the local telecommunications infrastructure.

Meanwhile the system of special funding accounts (before 1993) separated the PTEs' capital expenses and operating expenses. Under the rigid specification of fund uses according to fund sources, once capital was raised, the marginal investment cost appeared to be zero or external to the PTEs. As long as the PTEs and PTBs could raise capital from the state, banks, or users, investment in telecommunications network capacity would be risk free. This made it rational for the PTEs and PTBs to raise as much capital as possible to invest in infrastructure buildup. Beginning in 1993, the capital account system replaced the special funding accounts to allow PTEs more freedom to manage infrastructure development funds.

The shortcomings of the incentive structure are obvious. It provided very little incentive for PTEs to economize on operating expenses and investment expenses. Nor did it give enough stimuli for firms to improve service quality and to introduce new service products. However, the structure did give a big push to the expansion of the telecommunications sector through infrastructure investment, which has also been supported by a series of external incentives.

13.3 External Incentives to Infrastructure Investment

According to the "sixteen-character policy," telecommunications development should "mobilize resources of all concerned in telecommunications infrastructure development." One important policy is called "mobilizing four resources together ("sige yiqi shang," in Chinese), namely, the resources of government fiscal expenditure, user contributions, enterprise finance, and domestic and foreign loans (Wu and Zhang 1992).

13.3.1 High Fees, Strong Demands

In 1980 the State Council adopted a policy of developing intracity telephone service with intracity telephone revenue. Since then, intracity telephone service revenue has been fully retained by the local company. On top of that, local telephone companies were authorized to charge installation fees. In 1990, they were allowed to determine the installation charge according to the full installation cost. Installation fee revenue became a major financial source of intracity telephone development (Gao 1991). Wu Jichuan, the minister of the MPT, estimated that in 1995 the revenue from installation fees collected from installing 15 million telephone terminals amounted to Rmb 45 billion. This revenue accounted for about half of the annual investment capital in 1995.[7] By this estimation, the average installation fee per telephone terminal was Rmb 3,000 in 1995. Relative to the country's per capita income, China's installation charge is the highest in the world. Some experts worried that the extraordinarily high installation fee could become an impediment to residential telephone development (Wu and Zhang 1992). When infrastructure is built, a slow increase in subscribers may lead to underutilization of network capacities and thus undermine network externalities (Hu 1996). Notwithstanding that, the high installation fee policy has successfully financed infrastructure investment for intracity telephone services.

A footnote to this success is the equally impressive privatization of residential phone service subscription. Telephone service is no longer only an administrative tool of the state, but rather has become a private good for business operation and household consumption. In 1991, of all residential phone subscribers, private ones accounted for 75 percent. In more than ten provinces and municipalities, residential phones accounted for more than one-third of all phones (Hong and Qian 1992). In 1995, more than 80 percent of the increase in telephone exchange capacity was for residential uses.[8]

7. Wu Jichuan, interview, *Yazhou Zhoukan* (International Chinese News Weekly), 19 May 1996, 58.

8. Wu Jichuan, interview, *Yazhou Zhoukan* (International Chinese News Weekly), 19 May 1996, 57–58.

13.3.2 Attracting Non-MPT Investors

According to the "sixteen-character policy," the State Council has clearly defined the division of responsibilities between the MPT and local government. The MPT should invest in equipment and machinery while local government should invest in cable and line construction (Gao 1991). Telecommunications infrastructure development was incorporated into provincial development plans. Most provincial legislative bodies have passed laws and regulations to define the division of responsibilities between the MPT and local governments (*Yearbook* 1992, 181).

Financing postal and telecommunications investment was largely decentralized in the late 1980s. The Seventh Five-Year Plan (1986–90) stipulated that intraprovince telecommunications projects should mainly rely on local financing. Institutions or individuals should be encouraged to contribute to infrastructure investment. Those who invested in telecommunications projects could benefit by receiving priority in being connected to the network and lower charges for telecommunications services. In rural areas, whoever invested in infrastructure facilities could manage and operate the local exchange (You 1987).

The multi-investor feature of joint venture projects called for well-defined property rights. In July 1993, all PTEs established the capital account system to replace the earlier system of special funding accounts. The new system ensures that a PTE can raise capital in various ways and behaves as a legal person who manages the invested capital (*Yearbook* 1994, 235). In 1994, the MPT specified two measures to reward non-MPT investors in trial joint ventures. One is fixed-rate remuneration, and the other is dividend distribution (MPT 1995b, 513).

13.3.3 State Support

One state policy to facilitate telecommunications investment is to allow the postal and telecommunications sector a faster pace of capital depreciation. The State Council's six-point instruction of 1984 promised to gradually raise the accounting capital depreciation of the postal and telecommunications sector to 7 percent (State Council 1986, 243). From 1980 to 1990, the government adjusted the capital depreciation rate upward three times (*Yearbook* 1990, 271). A new reform of the PTE accounting system in July 1993 again raised the capital depreciation rate.[9] In 1995, the gross fixed capital depreciation rate was as high as 16 percent. The capital depreciation amounted to Rmb 40 billion, accounting for more than 40 per-

9. The detailed deprecation scale is five to seven years for telecommunications equipment, six to eight years for power equipment, ten to fifteen years for communications cables, and thirty to forty years for buildings (*Yearbook* 1994, 235).

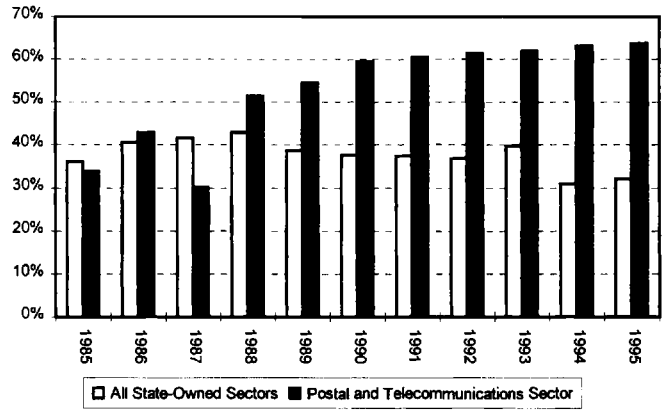

Fig. 13.4 Weight of technical upgrading and transformation: total fixed capital investment

Sources: China Statistical Yearbook (various years) and *Yearbook* (1991, 1996).

cent of total fixed capital investment.[10] Capital depreciation is the main source of technical upgrading and transformation (TUT) investment. The higher depreciation rate in the postal and telecommunications sector led to a higher than average weight of TUT investment in total fixed capital investment. Thanks to the policy, the weight of TUT investment has increased over the years in postal and telecommunications fixed capital investment (fig. 13.4).

To encourage telecommunications investment, imports of telecommunications equipment have received preferential tariff treatment. In 1985, for instance, the import tariff rate on automatic exchanges and telefax equipment was cut from 12.5 to 9 percent (*Almanac* 1986, 129). For projects involving foreign investment, import tariffs are usually exempted. In comparison, China's arithmetical average tariff rate was 39.9 percent before 1994. By 1996, the average tariff rate went down to 23 percent. Domestic producers of telecommunications equipment also enjoy better sales-related tax treatment, as shown in table 13.4.

In 1991 China introduced the "coordinating tax for directions of fixed capital investment," which is levied on indigenous enterprises. A zero tax rate applies to projects "urgently needed by the state." These projects include fixed capital investment in agriculture and water conservancy, the energy industry, transportation, postal and telecommunications, some important raw material industries, geological prospecting, certain medical projects, certain electronic and machinery projects, pollution control, urban public utilities, and some storage facilities. For those projects encour-

10. Wu Jichuan, interview, *Yazhou Zhoukan* (International Chinese News Weekly), 19 May 1996, 58.

Table 13.4 **Burden of Sales-Related Taxes of Industrial Enterprises by Sector (billion renminbi)**

Sector	Pretax Profit	Posttax Profit	Sales-Related Tax	Effective Rate (%)
	1990			
Heavy industry	102.891	34.684	68.207	7.59
Manufacturing	38.247	17.517	20.73	5.13
Special purpose equipment	3.195	1.557	1.638	5.44
Electronic and telecommunications	4.255	2.294	1.961	3.77
Instruments, meters, cultural and official machinery	1.166	0.592	0.574	5.69
National total	194.588	55.981	138.607	8.25
	1995			
Heavy industry	313.26	112.98	200.285	6.48
Manufacturing	110.94	42.60	68.34	4.79
Special purpose equipment	10.16	2.69	7.471	4.55
Electronic and telecommunications	18.50	11.68	6.819	2.81
Instruments, meters, cultural and official machinery	2.62	0.69	1.927	4.62
National total	505.03	163.49	341.54	6.45

Source: Lu (1997, 73–74).

aged by the state but constrained by energy supply and transportation facilities, the low 5 percent tax rate applies. For those projects inefficient in scale, using outmoded technologies, or making products already in excess supply, the state policy is to strictly control their development, and therefore the highest rate of 30 percent is applied.[11] All the other projects should be taxed at a rate of 15 percent (State Council 1992).

13.3.4 Foreign Investment but No Foreign Involvement

China's policy toward foreign investment in the telecommunications sector is twofold. On one hand, the government is keen to use foreign capital to develop the country's telecommunications industry. On the other hand, it bans foreign equity investment or direct operational control over ventures in China's telecommunications sector (MPT 1993, 455). Most foreign capital comes from government loans and loans by such international organizations as the World Bank, the Asian Development Bank (ADB), and the International Monetary Fund. There are also cases of borrowing of foreign businesses' export credit. Meanwhile, the manufacturing of telecommunications equipment has been open to foreign direct investment. In this field, Bell Shanghai and Shenda Telecom (in Shen-

11. Based on the same principle, the state has also promulgated a list of forbidden projects.

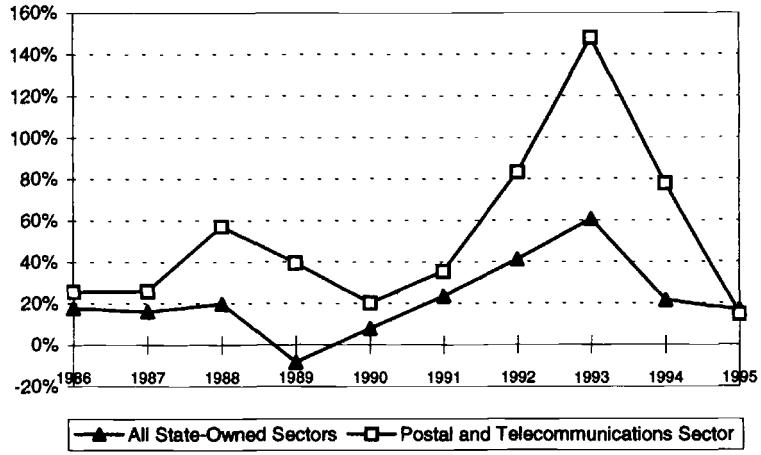

Fig. 13.5 Annual growth rate of fixed capital investment
Sources: China Statistical Yearbook (various years) and *Yearbook* (1991, 1996).

zhen) are the two earliest manufacturing joint ventures in China (Zhou 1991). The 1994 reform in foreign exchange management made Chinese currency virtually convertible for current account transactions and greatly reduced the exchange risk in using foreign capital.

Policies to mobilize capital for telecommunications infrastructure development have been very successful. Figure 13.5 shows that investment in the postal and telecommunications sector increased by leaps and bounds in the decade after 1984.[12] The growth was spectacular in the first half of the 1990s. Fixed capital investment in the sector during the Eighth Five-Year Plan period was twelve times that invested during the Seventh Five-Year Plan period (Wu 1996). According to the MPT, during the first half of the 1990s, investment in telecommunications infrastructure was mainly financed through three sources. One was installation fees collected from users, which accounted for 40 percent of the capital. The second was domestic and foreign government loans, accounting for about 30 percent of total capital. The remaining 30 percent came from PTEs' profits and capital depreciation (*Lianhe Zaobao* [United Mornings, Singapore], 8 April 1994, 23).

13.4 Efficiency of Infrastructure Buildup

An interesting issue is whether China's mammoth investment in the postal and telecommunications sector has increased supply capacity cost-

12. Investment in telecommunications accounts for about 80 percent of total fixed capital investment in the postal and telecommunications sector.

effectively. To examine this issue, we estimate a regression model to evaluate the cost-effectiveness of telecommunications investment to increase telephone lines in the Asia-Pacific region during the period 1988–94 (see appendix C for technical details). The model is used to forecast China's main telephone line increase during the same period based on official statistics of investment in the postal and telecommunications sector. The forecast figures are compared with real figures of main telephone line increase to evaluate investment efficiency.

The forecast figures in the upper panel of table 13.5 are based on U.S.-dollar-denominated (deflated) investment figures published by the International Telecommunication Union (see appendixes A and C for a definition). The results show that China's telecommunications investment has been surprisingly cost-effective. It has increased telephone lines three times more than the forecast figures. Because of the drastic devaluation in the official exchange rate of the Chinese currency from U.S.$1.00 = Rmb 3.72 in 1987 to Rmb 8.62 in 1994, we reestimated the figures using Rmb-denominated figures published by the Chinese authorities. After being deflated by China's retail price inflation rates, these figures were converted into U.S. dollars using the exchange rate of 1987. The resulting figures in the lower panel of table 13.5 still show that China's investment has been on average two times more effective in increasing telephone lines than forecast.

For comparison, table 13.6 lists the average percentage differences between the forecast line increase and the actual line increase for other countries and regions. China's extraordinary performance in telecommunications investment is more evident by this comparison. Of the seventeen countries and regions, the actual figures of five are within about ±30 percent of the forecast values. Three see their actual figures about 55 to 75 percent below forecast values. Five managed to achieve line increases more than 50 percent higher than forecast levels. The highest is Iran, whose line increase was 1.1 times higher than the forecast level. This achievement, however, still appears to have been far below the Chinese performance.

The impact of statistical discrepancy on the reliability of these results is uncertain. All investment figures (including China's) used in this model include investment in land and buildings. On one hand, Chinese statistics may undervalue land cost since the accounting procedure only records the official compensation price if the land is acquired from the original users. Since the property market was underdeveloped until the early 1990s, the official valuation of the land compensation rate might be far from realistic.[13] It is noteworthy that Chinese telecommunications investment has been intense in coastal cities, where actual land costs are no longer cheap

13. Since July 1993, China's PTEs have adopted international standards in accounting assets and liabilities (*Yearkbook* 1993, 234–35). How effective the change has been in improving asset accounting remains an unresolved issue.

Table 13.5 **China's Forecast Main Telephone Line Increases Compared with Actual Line Increases (thousand)**

	1988	1989	1990	1991	1992	1993	1994	1995	Average
Based on Fixed U.S. Dollar Values and Nominal Exchange Rate									
Lines	4,727.00	5,680.40	6,850.30	8,450.60	11,469.1	14,074.0	27,230.00	40,706.00	
Forecast line increase	318.45	399.96	525.40	471.31	631.49	1,171.25	2,882.98	3,689.11	
Actual line increase	730.00	953.40	1,169.90	1,600.30	3,018.50	2,604.90	13,156.00	13,476.00	
Percentage difference	129	138	123	240	378	122	356	265	219
Based on Renminbi Values Deflated by China's Price Index and Fixed Exchange Rates									
Forecast line increase	318.64	339.51	405.44	481.54	715.90	1,321.01	3,027.32	4,846.88	
Actual line increase	730.00	953.40	1,169.90	1,600.30	3,018.50	2,604.90	13,156.00	13,476.00	
Percentage difference	129	181	189	232	322	97	335	178	208

Note: The forecast in the upper panel is made on the investment figures published by the International Telecommunication Union, deflated by the U.S. producer price index. The forecast in the lower panel is made on the investment figures published in the *Yearbook of China Transportation and Communications.* The investment figures are first deflated by China's price index and then converted to U.S. dollars based on the 1987 exchange rate (US$1.00 = Rmb 3.72).

Table 13.6 **Average Percentage Difference between Forecast Main Telephone Line Increases and Actual Line Increases, 1987–94**

Country	Average Percentage Difference	Teledensity		Digitization	
		1987	1994	1987	1994
Australia	−74.20	43	50	26[a]	51
New Caledonia	−59.43	16	23	80[a]	100
New Zealand	−58.21	41	47	37	98
Bahrain	−50.68	18	25	49	100
Taiwan, China	−44.59	31	40	31[a]	84
Singapore	−36.62	33	47	24	100
Israel	−34.16	32	39	22	81
Macau	−28.63	18	36	80	100
Hong Kong	−12.50	35	54	61[b]	100
Oman	10.94	4	8	44[a]	100
Korea (Rep.)	23.51	20	40	14	59
Indonesia	39.30	0.4	1.3	36[a]	92
United Arab Emirates	54.78	18	33	100[a]	100
Malaysia	64.84	7	15	78[a]	93
India	72.16	0.4	1.1	30[a]	70
Sri Lanka	104.38	0.6	1.0	67[a]	96
Iran	110.77	3	7	13[a]	49

Source: Appendix C.

[a]1990 or 1991 data.

[b]1989 data.

by international standards. On the other hand, however, China's statistics for investment costs could be biased upward because they refer to total investment in both the postal sector and the telecommunications sector. Meanwhile, we have used the official exchange rate in 1987 to convert the renminbi into U.S. dollars to get the results in the lower panel of table 13.5. This exchange rate (US$1.00 = Rmb 3.72) largely overvalued the renminbi and hence might again have inflated capital costs.

A plausible factor behind the apparently higher investment effectiveness in China might be low labor cost. Both low land cost and low labor cost in many Chinese regions may have saved the Chinese PTEs some capital costs. However, since the late 1980s labor costs in the coastal areas have been escalating rapidly with the standard of living. On top of that, our model includes teledensity as an independent variable, which is highly correlated with per capita GNP (see appendix B). This feature of the modeling has already largely controlled for the impact of low labor cost and land cost due to underdevelopment.

Another possible factor may be that China's population density data are averaged over the entire nation while most new telephone lines were laid in coastal urban areas, where the population density is much higher. Given the relatively small estimated value of the population density vari-

Table 13.7 **Percentage of Telephone Lines Connected to Digital Exchanges, 1994**

Country/Region	Percentage
United States	69.00
Europe	52.86
Africa	67.75
Latin America	81.09
Asia-Pacific region	72.43
Japan	75.00
Taiwan	83.79
China	97.2
Singapore and Hong Kong	100

Source: ITU (1995a).

able's coefficient, however, this factor may only play a secondary role if China's investment effectiveness has been overestimated.

Being a "late starter" in telecommunications infrastructure development may have been a favorable factor. The inclusion of teledensity in the model has only partly taken care of this factor. In table 13.6, we note that all eight overachievers had low teledensities ($\leq$ 20) in 1987 and either raised their digitization rate considerably during the period or kept a high digitization rate all through.

As described in section 13.3, Beijing has followed a policy of giving the green light to telecommunications equipment imports and lightening the tax burden on domestic equipment manufacturers. Thanks to this state policy, China's telecommunications sector has faced low barriers to equipment trade and competitive domestic equipment supply. Between 1988 and 1993, while China's main telephone lines grew at a compound annual rate of 19.9 percent, its telecommunications equipment imports grew at a compound rate of 26.6 percent.[14] Telecommunications investors, therefore, enjoyed the advantages of being able to employ state-of-the-art technologies at good prices.

In the earlier analysis of the PTE incentive structure, we noted that the PTEs behaved like output or revenue maximizers who did all they could to expand supply capacity. Investment costs and risks involving the purchase of new and expensive equipment were minimal or external to them. All this might have encouraged them to employ and import whatever technology would be most effective and efficient in increasing supply capacity (number of main lines). Table 13.7 shows that China's telecommunications network is already at the forefront compared to other countries.

The last but not the least factor in cost-effectiveness could be the MPT's ability to enforce unified planning in China's telecommunications develop-

14. Calculated according to ITU (1995a, 1995b).

ment. Despite some reports of connection problems between the MPT's public network and private networks developed by non-MPT departments, China's public network has been built on the unified MPT standard. This may have helped China avoid costs arising from incompatibility of different network standards.

13.5 Concluding Remarks

From the above discussion, we can conclude that the speedy buildup of China's telecommunications infrastructure has been a market-oriented development with strong state initiatives. China's central planners played a pivotal role in introducing a variety of innovative measures to push the industry onto the takeoff track. Meanwhile, local driving forces riding on soaring market demand have repeatedly overshot centrally planned targets. Financial accountability of enterprises, prices and fees reflecting costs and scarcity, and government support with local initiatives, all have contributed to the spectacular growth of the telecommunications business. On top of these factors, the unique incentive structure for PTEs and PTBs has provided great stimuli to supply capacity expansion.

Looking into the future, we are interested in whether and how long China will keep this momentum in telecommunications infrastructure buildup. On the demand side, according to a study by an MPT research institute, in the late 1980s every dollar of investment in telephony service could increase national output by $6.78. The 6.78 output-input ratio is much higher than Japan's 2.5 ratio and India's 4.0 ratio (You 1987). China's policymakers and central planners are well aware of the importance of telecommunications to modern economic development. China's Ninth Five-Year Plan (1996–2000) aims to triple telecommunications infrastructure capacity in five years (table 13.8). The MPT plans to keep the telecommunications sector growing twice as fast as the national economy until the year 2010.

Table 13.8 Main Telecommunications Targets of China's Ninth Five-Year Plan: 1996–2000

Ninth Five-Year Plan: 1996–2000	Planned for 2000	Achieved in 1995
Urban switchboard capacity (lines)	150 million	54.56 million
Long-distance phone lines	2,800,000	735,545
Main telephone lines	123 million	44 million
Mobile phone lines	18 million	3.6 million
Telephone terminals per 100 residents	National: 10 Urban: 30–40	4.66
Average annual growth rate of postal and telecommunications turnover (%)	20	35.1 in 1991–95

Source: Zhang (1996).

Uncertainty may arise in capital financing. The Economist Intelligence Unit in Hong Kong has estimated that the telecommunications targets set in the Ninth Five-Year Plan would require U.S.$60 to $80 billion to fulfill. In comparison, a total of $29 billion was invested in telecommunications infrastructure between 1991 and 1995 (EIU 1997). During the period 1991–95, foreign capital accounted for about 20 percent of the MPT's total telecommunications investment. The main sources were supplier credits, commercial investment, government soft loans, and international loans from the World Bank and the ADB. The OECD countries reached an agreement in 1993 to cut government soft loans to telecommunications projects in China. The World Bank and the ADB, too, will gradually eliminate loans to telecommunications projects in China (Mueller and Tan 1997, 108). If China continues to ban foreign equity investment and forbid direct foreign operational control, it must find innovative ways to raise capital. One such way is to raise capital in overseas stock markets. For instance, in October 1997, China Telecom (Hong Kong) launched the biggest initial public offering in Hong Kong Stock Market history to raise HK$540 to $718 billion (*Business Times* [Singapore], 14 October 1997, 1).

On the supply side, the ongoing corporatization of PTEs and the development of plural ownership of asset investment reinforce the momentum of infrastructure development. As discussed earlier, the incentive structure for PTEs strongly encourages revenue maximization and business expansion. In view of the shortcomings of this incentive structure, the MPT reformed the wage fund formula in 1995. The new formula links 30 percent of wage increases to national network revenue, 50 percent to the enterprise's per employee operating revenue, and 20 percent to national network profit and the enterprise's cost-revenue ratio. The new formula is intended to restrain enterprises from hiring new staff and to encourage cost savings (*Yearbook* 1996, 235). Since revenue increase is still the dominant factor in wage determination, the incentive structure will continue to be proexpansion.

When infrastructure development goes into less densely populated areas, the cost per line must go up. In this regard, competition may play a crucial role in containing the cost rise by bringing in new technologies.

In recent years, China has tasted the benefits of competition, albeit limited, in the telecommunications market. Starting around 1988–89, the government deregulated some parts of the telecommunications industry. The reform in 1988 shifted more decision-making authority regarding procurement, operations, network development, and financing from MPT headquarters to municipal and county PTEs. In 1989, the MPT instructed all province-level PTAs to set up telecommunications regulatory bodies. Meanwhile, the introduction of terminal equipment licensing under the MPT largely deregulated the terminal equipment used by customers of the network (*Yearbook* 1996, 232). As a result, the PTEs could choose among

Table 13.9 **Main Telephone Lines, Mobile Phones, and Pager Subscribers (thousand)**

Year	Main Line	Mobile Phone	Pager
1990	6,850	18	437
1991	8,451	48	874
1992	11,469	117	2,220
1993	17,332	638	5,614
1994	27,295	1,568	10,330
1995	40,706	3,629	17,392
1996	54,950	6,850	25,360
1997	70,310	13,240	29,690

Source: Yearbook (various years).

competing domestic and even foreign equipment suppliers. The purchasing and production of network equipment became highly competitive. This will continue to work together with low trade barriers to equipment imports to constrain investment cost increases.

Non-MPT suppliers of value-added services, mobile telephone services, and satellite communications services emerged and prevailed in many regions during the early 1990s. In 1993 the State Council formally deregulated the mobile telephone service market and very small aperture terminal communications by authorizing the MPT to license these service suppliers (State Council 1994, 468–69). By the end of 1995, the MPT had licensed 2,136 mobile telephone service suppliers and 68 interprovince telecommunications service providers (*Yearbook* 1996, 231–32). Thanks to competition in this market section, China has made great progress in developing its mobile telephone business (table 13.9).

In 1993, the State Council made a landmark decision to award a basic telecommunications license to China United Telecom (or Unicom, Beijing; MPT 1995a, 512). It was set up by the Ministry of Electronic Industries, the Ministry of Railways, the Ministry of Electric Power, and thirteen major companies. The carrier intends to compete with the MPT in the long-distance and international services market. Another player is Ji Tong Communications Co. Ltd. (Beijing), a value-added network (VAN) operator set up by the State Economic and Trade Commission. Its charter is to build a nationwide backbone linking the networks belonging to government ministries, universities, and research and state-owned organizations. It also is supposed to offer VAN services to government departments and the private sector. Both new players are shareholder based but largely state owned and controlled.

In 1994, Beijing announced the "eight policies of telecommunications development" (*Yearbook* 1995, 225), which outlined China's strategies of developing the sector:

1. Giving priority and policy support to the telecommunications sector
2. Planning network and service development centrally
3. Focusing on the construction of a unified nationwide public network
4. Licensing value-added and mobile telecommunications services; deregulating equipment manufacturing market; open tender for network projects
5. Requiring independent accounting and hierarchical administration for PTEs; linking employee rewards to enterprise performance
6. Supporting PTEs to raise capital from various ways and collect installation fees
7. Promoting network modernization and human resource development
8. Importing foreign equipment and technology and utilizing foreign fund sources

In these policies, one can observe a gradual approach toward a less regulated and less monopolized market. The future of China's telecommunications business lies in a new telecommunications law, which is being drafted by the MPT. As pointed out by Liu Cai, director general of policy and regulation of the MPT, Chinese telecommunications development is hampered by outmoded legal and regulatory constraints (China's MPT director general 1996). According to him, the legislation will address the following objectives:

Maintaining the current pace of business expansion, focusing on telecommunications' role as a multiplier of economic growth
Decentralizing the present structure of telecommunications enterprises
Assuring availability of advanced technology, both from foreign sources and expanded domestic R&D facilities
Strengthening competition among foreign and domestic suppliers of network equipment, including the possible introduction of open bidding
Encouraging improvements in financing telecommunications expansion, including changes in user-pricing patterns

Regulatory reform at the central government level will endorse the reform process initiated in the 1980s by legally defining what Liu called "the three separations." They are (1) separating the MPT's postal and telecommunications units, (2) separating the MPT's regulatory and operational functions, and (3) separating telecommunications manufacturing functions from service obligations. Therefore, the MPT will be set up as solely a regulatory body and China Telecom as an operational body. The two organizations will be completely separate. Compatible with the new law, the Ministry of Electronic Industries is likely to be transformed into a trade association. More network development decisions will be devolved

to provincial and municipal administrations. The legislation is expected to be submitted to China's State Council for approval in 1997. These coming changes will surely be a boost to domestic competition in the telecommunications sector.

As for letting foreign companies get involved in China's telecommunications sector, the MPT still believes conditions are not yet ripe. It has set the year 2010 as the earliest date for a possible change in the policy banning foreign involvement and direct investment stakes. A major argument for maintaining the policy is that "the development of the telecommunications sector is still dictated largely by government policy rather than market economics, and therefore unsuitable for foreign involvement."[15] The past success of rapid development has obviously become a subtle excuse for not opening the door sooner.

The existing policy toward foreign equity investors conflicts with China's bid to join the World Trade Organization (WTO). The WTO's acceptance of China will hinge on whether China agrees on terms that mandate opening up its service sectors, including the telecommunications market. If China intends to commit itself to meeting the standards set in the WTO's hard-won Global Telecommunications Pact, the new telecommunications legislation must allow more room for reform than that suggested by "the three separations."

It remains a question whether China is ready to play by the WTO rules by opening the telecommunications sector to foreign competitors. China's remarkable success in telecommunications development so far contributes to policymakers' reluctance to allow foreign equity investment in this lucrative industry. Given its successful experience in the past decade, China may well keep going on its own way to building a world-class telecommunications infrastructure.

15. Wu Jichuan, statement reported by AFP, *Straits Times* (Singapore), 27 August 1997, 45.

Appendix A

Table 13A.1 Basic Statistics of China's Telecommunications Industry, 1994

Statistic	China	Asia	World
Financial data, 1992 (U.S.$)			
Income[a] per main telephone line	228.83	889.97	1,253.52
Expense[b] per main telephone line	205.07	787.82	834.69
Investment[c] per main telephone line	246.32	284.00	225.10
Tariff structure for residential users, 1994 (U.S.$)			
Installation charges	540.00	108.40	132.36
Monthly subscription	4.00	5.67	6.30
Local call rate (three minutes)	0.03	0.08	0.09
Residential subscription tariff as percentage of per capita GNP	0.8	1.4–162.8	0.2–162.8
Basic quantity data, 1994			
Main lines per 100 residents	2.29 (3.36)[d]	4.79	11.57
Long-distance calls per main line[e]	249.0[d]	35.45 (India)	330.41 (Brazil)
Outgoing international traffic (minutes per subscriber)	43.0	56.8	85.0
Waiting time for subscription[f] (years)	0.3	1.1	1.4
Satisfied demand[g]	94.4	91.6	93.4
Completion rate (long distance; %)	45		
Completion rate (local; %)	58		

Sources: ITU (1995a, 1995b) and *Yearbook* (various years).

Note: U.S. dollar figures are reached by applying the average annual exchange rate to the figure reported in national currency.

[a]Income consists of all telecommunications revenue earned during the financial year under review, including income from subscribers and other national and foreign telecommunications administrations after deduction of payment to other administrations or organizations for outgoing telecommunications traffic. It does not include moneys received by way of loans or moneys received from refundable subscribers' contributions or deposits.

[b]Expense refers to expenditure other than investments. It includes operational expenditure, depreciation, interest, taxes, etc.

[c]Investment means expenditure associated with acquiring ownership of property and plant. Due to difficulties of interpreting the concepts of depreciation among different countries, only gross investment figures are available. The "investment per main telephone line" figure for the world may be a slight underestimate since a few small countries' investment figures are not available.

[d]1995 data.

[e]"Long-distance calls per main line" is obtained by dividing trunk (toll) traffic by the number of main lines. Since Asia average and world average figures are not available, figures for India and Brazil are used.

[f]Waiting time is approximate number of years applicants must wait for a telephone line to be connected.

[g]Satisfied demand is obtained by dividing the number of main lines by the total demand for main telephone lines.

Table 13A.2 Main Events in China's Telecommunications Industry since 1979

Date	Event
June 1979	State council approved the Ministry of Posts and Telecommunications' (MPT's) proposal of administrative reform to set up a system of "dual leadership" of the MPT and provincial governments over telecommunications sector. MPT became the dominant central planner of nationwide postal and telecommunications development. A vertically organized hierarchy of MPT, postal and telecommunications administrations (PTAs), and postal and telecommunications bureaus (PTBs) emerged.
January 1980	MPT and State Urban Development Bureau decided to incorporate telecommunications infrastructure development into urban planning and construction code.
June 1980	MPT and Ministry of Finance authorized local PTAs to charge telephone installation fees amounting to Rmb 300–2,000 for each residential line. "Special funding accounts" system was introduced to manage telecommunications infrastructure maintenance and development.
March 1982	State Council approved MPT's proposal to • Allow urban telephone enterprises to retain all profits • Reduce other PTEs' profit submission rate from 20% to 10% • Adjust postal and telecommunications service rates and decentralize the setting of nonbasic local service rates • Raise fixed capital depreciation rate to 7%
October 1984	State Council stipulated a "six-point instruction" to give priority to postal and telecommunications development, which endorsed a policy of "three 90 percent" (see section 13.3 for more details).
1984–86	With accounting reform, the MPT contracted performance responsibilities to local PTAs and PTBs.
1985	The Seventh Five-Year Plan (1986–90) stipulated that intraprovince telecommunications projects should mainly rely on local financing.
1986–1990	MPT made adjustments to a wide range of telecommunications service rates and raised capital depreciation rate.
August 1988	MPT linked PTBs' wage fund increases to their revenue increases.
October 1988	MPT adopted a new formula to calculate "enterprise own revenue."
1988	Beijing announced the "sixteen-character policy" for telecommunications infrastructure development (see section 13.3). MPT granted its national manufacturing, construction, and purchasing departments the status of separate legal entities or greater financial and managerial independence. MPT set up the Directorate General of Telecommunications (DGT) and the Directorate General of Posts (DGP).
1989	MPT instructed all province-level PTAs to set up telecommunications regulatory bodies. MPT introduced terminal equipment licensing scheme, which deregulated the use of terminal equipment.
December 1990	Intracity telephone rates were widely adjusted. Local telecommunications companies were authorized to • Set their own intracity rates not exceeding the cap set by the MPT • Charge cost-based installation fees

(*continued*)

Table 13A.2 (continued)

Date	Event
1990–93	Non-MPT suppliers of value-added services, mobile telephone services, and satellite communications services emerged and prevailed in some regions.
June 1992	MPT stipulated the Re-statement on Forbidding Joint Operation of Postal and Telecommunications Business with Foreign Companies.
July 1993	All postal and telecommunications enterprises (PTEs) established the capital account system to manage infrastructure development funds.
	(Accounting) depreciation of telecommunications capital accelerated (equipment, 5–7 years; network, 10–15 years).
September 1993	State Council formally deregulated the mobile telephone service market and very small aperture terminal communications by authorizing MPT to license these service suppliers.
April 1994	MPT awarded a basic telecommunications license to China United Telecom and a value-added network operating license to Ji Tong Communications Co. Ltd. (Beijing).
	Nationwide tax reform unified corporate tax rates into an across-the-board 33% rate for all enterprises. Renminbi became convertible for current account transactions
1994	MPT froze all subsidiaries' employment and revised PTEs' wage-fund–revenue linkage formula to give larger weight to local revenue.
	The government announced the "eight policies of telecommunications development" (see section 13.6 for details).
September 1994	MPT specified two measures to reward non-MPT investors in trial joint ventures: fixed-rate remuneration and dividend distribution.
1995	MPT's China Telecom (DGT) formally registered with the government for the first time as an enterprise legal person.
	Local PTEs started the process of "corporatization" under China's Corporation Law.
	MPT revised PTEs' wage-fund–performance linkage formula to restrain employing new staff and encourage cost control.
October 1997	China Telecom launched 144 million initial public offer shares on Hong Kong Stock Market.

Source: Yearbook (various years).

Appendix B

Correspondence between Teledensity and Per Capita GNP

Objective

The objective is to test the correspondence between teledensity and GNP per capita for low-income and middle-income countries. See the note to table 13.3 for the World Bank definition of low- and middle-income countries.

Data

Teledensity statistics (defined as main telephone lines per 100 residents) are from ITU (1995a). Per capita GNP data are from the World Bank

(1989, 1996). There are 81 observations for the year 1987 and 93 observations for the year 1994.

Estimated Regressions for 1987 and 1994

The following equation is estimated by regressing the logarithmic values of teledensity data (TELDEN) on the logarithmic values of per capita GNP data (LNPCGNP):

$$\text{LNTELDEN}_{it} = \alpha + \beta \cdot \text{LNPCGNP}_{it} + \varepsilon_{it}.$$

Table 13B.1 **Regression Results for 1987**

Statistic	Value
Multiple R	.9026
R^2	.8147
Adjusted R^2	.8124
Standard error	.6769
Observations	81

ANOVA	df	SS	MS	F	Significance F
Regression	1	159.2067	159.2067	347.4170	1.18E-30
Residual	79	36.2024	0.4583		
Total	80	195.4091			

	Coefficient	Standard Error	t-Statistic	P-Value	Lower 99%	Upper 99%
Intercept	−9.2258	0.5064	−18.2170	5.16E-30	−10.5625	−7.8890
LNPCGNP	1.4263	0.0765	18.6391	1.18E-30	1.2243	1.6283

Table 13B.2 **Regression Results for 1994**

Statistic	Value
Multiple R	.8401
R^2	.7057
Adjusted R^2	.7025
Standard error	.9096
Observations	93

ANOVA	df	SS	MS	F	Significance F
Regression	1	180.5663	180.5663	218.2365	6.6548E-26
Residual	91	75.2923	0.8274		
Total	92	255.8587			

	Coefficient	Standard Error	t-Statistic	P-Value	Lower 99%	Upper 99%
Intercept	−7.1391	0.5642	−12.6544	9.06E-22	−8.6234	−5.6548
LNPCGNP	1.2025	0.0814	14.7728	6.65E-26	0.9883	1.4166

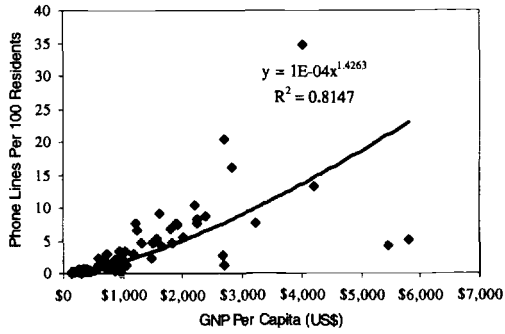

Fig. 13B.1 Teledensity vs. per capita GNP, 1987

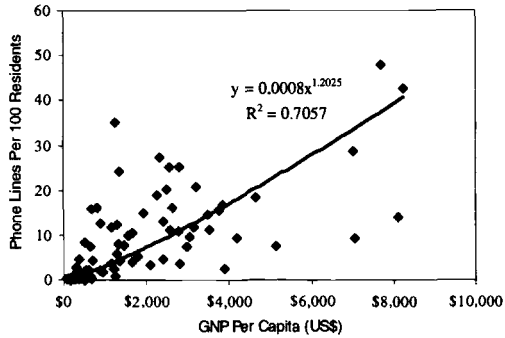

Fig. 13B.2 Teledensity vs. per capita GNP, 1994

Appendix C

Telecommunications Investment and Increase of Main Telephone Lines

Objective

The objective is to find the effectiveness of telecommunications investment in increasing main telephone lines in the Asia-Pacific region during 1987–94.

Data

Main telephone line statistics and telecommunications investment statistics for seventeen Asia-Pacific countries (China not included) during 1987–94 are from ITU (1995a). According to the ITU definition, investment means expenditure associated with acquiring ownership of property and plant. This includes expenditure on initial installations and on additions to existing installations where the usage is expected to be over an

extended period of time. Data are gross investment figures, which include cost of land and buildings.

Investment figures are deflated by the U.S. producer price index. There are 114 observations. Population density (number of persons per square kilometer) and teledensity (main telephone lines per 1,000 persons) statistics are from World Bank (1995) and ITU (1995a).

Regression Model

The logarithmic value of annual line increase (unit: thousand lines), LOGLINC, is regressed on three variables:

1. Previous year's logarithmic value of telecommunications investment (unit: million U.S. dollars), LOGINV
2. Relative teledensity in sample countries, RTELDEN (individual country's teledensity divided by average teledensity)
3. Relative population density, RPOPDEN (individual country's population density divided by average density)

$$\text{LOGLINC}_{it} = \alpha + \beta_1 \text{LOGINV}_{it-1} + \beta_2 \text{RTELDEN}_{it} + \beta_3 \text{RPOPDEN}_i + \varepsilon_{it}.$$

RTELDEN is included in the model on the assumption that countries with low teledensity can save capital cost of infrastructure as "late starters." They tend to be more efficient in increasing telephone lines than the earlier starters. This is partially because earlier starters also have to incur

Table 13C.1 Regression Results

Statistic	Value
Multiple R	.8962
R^2	.8032
Adjusted R^2	.7978
Standard error	.8258
Observations	114

ANOVA	df	SS	MS	F	Significance F
Regression	3	306.1180	102.0393	149.6116	1.13E-38
Residual	110	75.0231	0.6820		
Total	113	381.1411			

	Coefficients	Standard Error	t-Statistic	P-Value	Lower 95%	Upper 95%
Intercept	−1.1882	0.2929	−4.0569	9.33E-05	−1.7686	−0.6078
LNINV	1.0544	0.0525	20.1019	1.26E-38	0.9505	1.1584
RPOPDEN	0.0992	0.0341	2.9072	0.0044	0.0316	0.1669
RTELEDEN	−0.2527	0.1172	−2.1562	0.0332	−0.4850	−0.0204

higher replacement cost in investment to upgrade their existing networks. Late starters do not have the earlier starters' burdens of replacing out-of-date facilities, and they can use the latest technologies to build their telecommunications networks. Low teledensity is also associated with low per capita income levels, which in turn may imply lower land cost and labor cost in infrastructure construction. For these reasons, we expect the coefficient of RTELDEN to be negative.

High population density should have a positive impact on the cost-effectiveness of telecommunications investment. With fixed-line telephony, the connection cost per telephone line in a densely populated area is usually cheaper than in a sparsely populated region. Therefore, we expect the coefficient of RPOPDEN to be positive. With development of wireless telephony, however, the significance of this impact is likely to be weaker.

References

Almanac of China's foreign economic relations. 1986. Beijing: Foreign Trade and Economic Cooperation Press.

Almanac of China's tertiary industry. 1993. Beijing: China Statistics Press.

China's MPT director general outlines issues for new telecom law. 1996. International Communications Studies Program web page. 11 December. Available at http://www.csis.org/ics/.

China statistical yearbook. Various years. State Statistics Bureau. Beijing: China Statistics Press.

Documents of the twelfth national congress of the Communist Party of China. 1982. Beijing: People's Press.

EIU (Economist Intelligence Unit). 1997. Telecommunications: Easier access. In *Business Report: China,* 15–18. Hong Kong: Economist Intelligence Unit.

Gao Yangzhi. 1991. Shanghai's telephone network: Status quo and development strategy. *P & T Economy* 16:22–28.

Guo, R. C., and Y. Xu. 1992. *Business accounting system for postal and telecommunications enterprises* (in Chinese). Beijing: Beijing University of Posts and Telecommunications Press.

Hong Xiuyi and Qian Yongwei. 1992. The trend of residential telephone development in China (in Chinese). *P & T Economy* 21 (4): 19–23.

Hu Shiliang. 1996. Some thoughts on the reform of telecommunications fees in China (in Chinese). *P & T Economy* 34 (1): 19–21.

ITU (International Telecommunication Union). 1995a. *ITU statistical yearbook, 1987–94.* Geneva: International Telecommunication Union.

———. 1995b. *World telecommunication development report.* Geneva: International Telecommunication Union.

Li Guohua. 1996. Post and telecommunications business in new transition (in Chinese). *P & T Economy* 37 (4): 10–15.

Liu Shuping. 1992. Introduction to the Eighth Five-Year Plan of postal and telecommunications sector (in Chinese). In *Yearbook of China transportation and communications,* 168. Beijing: China Transportation and Communications Society.

Liu Zhaoquan. 1992. The development of P & T and reform of asset management (in Chinese). *P & T Economy* 18 (1): 2–4.

Lu, Ding. 1994. The management of China's telecommunications industry: Some institutional facts. *Telecommunications Policy* 18 (3): 195–205.

———. 1997. *State intervention and business in China: The role of preferential policies.* London: Elgar.

Luo Guilin. 1996. Correctly deal with several issues in the transformation of telecommunications growth mode (in Chinese). *P & T Economy* 37 (4): 5–7.

Luo Yunchao. 1992. The monopoly nature of P & T industry and its effects on operation. *P & T Economy* 21 (4): 15–17.

Ma Qiang. 1992. Ways to estimate telecommunications rates and an international comparison of rates (in Chinese). *P & T Economy* 18 (1): 27–30.

Ministry of Finance, Ministry of Posts and Telecommunications, and State Bureau of Price. 1986. Directive on urban telephone installation fees (June 1980). In *Yearbook of China transportation and communications.* Beijing: China Transportation and Communications Society.

MPT (Ministry of Posts and Telecommunications). 1986. Proposal to reform postal and telecommunications administration system (April 1979). In *Yearbook of China transportation and communications.* Beijing: China Transportation and Communications Society.

———. 1989a. Instruction on improved accounting system for PTEs (October 1988). In *Yearbook of China transportation and communications.* Beijing: China Transportation and Communications Society.

———. 1989b. Measures to link PTA wage funds to revenues (August 1988). In *Yearbook of China transportation and communications.* Beijing: China Transportation and Communications Society.

———. 1993. Re-statement on forbidding joint operation of postal and telecommunications business with foreign companies (20 June 1992). In *Yearbook of China transportation and communications.* Beijing: China Transportation and Communications Society.

———. 1995a. Approval of China United Telecom's scope of business (14 April 1994). In *Yearbook of China transportation and communications.* Beijing: China Transportation and Communications Society.

———. 1995b. Instruction on trial joint venture projects to speed up telecommunications development (September 1994). In *Yearbook of China transportation and communications.* Beijing: China Transportation and Communications Society.

MPT Planning Department. 1987. Main goals of China's postal and telecommunications development in the Seventh Five-Year Plan period (in Chinese). In *Yearbook of China transportation and communications,* 8–9. Beijing: China Transportation and Communications Society.

———. 1993. Postal and telecommunications sector (in Chinese). In *Yearbook of China's tertiary industry.* Beijing: China Statistics Press.

———. 1996. Goals of China's postal and telecommunications development in the Ninth Five-Year Plan period (in Chinese). In *Yearbook of China transportation and communications,* 542–43. Beijing: China Transportation and Communications Society.

Mueller, M., and Z. Tan. 1997. *China in the information age: Telecommunications and the dilemmas of reform.* Westport, Conn.: Praeger.

State Council. 1986. Instruction to the postal and telecommunications management (12 October 1984). In *Yearbook of China transportation and communications.* Beijing: China Transportation and Communications Society.

———. 1992. The provisional regulation on the PRC's direction-adjustment tax

on fixed capital investment (16 April 1991). In *Almanac of China's economy,* 693–700. Beijing: Economic Management Press.

———. 1994. Approval of the MPT's proposal to enforce regulation of telecommunications service markets (3 August 1993). In *Yearbook of China transportation and communications.* Beijing: China Transportation and Communications Society.

Sun Yaming. 1992. Issues related to pricing policies regarding P & T new services (in Chinese). *P & T Economy* 18 (1): 36–37.

World Bank. 1989. *World development report.* New York: Oxford University Press.

———. 1995. *World development report.* New York: Oxford University Press.

———. 1996. *World development report.* New York: Oxford University Press.

Wu Changgeng and Zhang Xuan. 1992. An analysis of the seemingly high profit in the industry (in Chinese). *P & T Economy* 18 (1): 6–9.

Wu Houzeng. 1992. Discussion of the installation fee for private residential telephones (in Chinese). *P & T Economy* 20 (3): 44–46.

Wu Jichuan. 1996. Carefully study the experience of fulfilling the Eighth Five-Year Plan, work hard to fulfill the Ninth Five-Year Plan, and strive for making China a country with the most advanced postal and telecommunications sector by the year 2010 (in Chinese). In *Yearbook of China transportation and communications,* 16–17. Beijing: China Transportation and Communications Society.

Xiao, Jinxue. 1992. Views on the transition of operational mechanism of posts and telecommunications enterprises (in Chinese). *P & T Economy* 21 (4): 17–19.

Xu Yan. 1996. Competition without privatization: The Chinese path (in Chinese). Paper presented at the eleventh biennial conference of the International Telecommunications Society, Seville, Spain, 19 June.

Yang Peifang. 1991. On the goals and ways of a harmonic development of telecommunication (in Chinese). *P & T Economy* 16 (3): 2–4.

Yearbook of China transportation and communications. Various years. Beijing: Yearbook House of China Transportation and Communications.

You Zhengyan. 1987. Status of postal and telecommunications sector and industrial policies (in Chinese). In *Yearbook of China transportation and communications,* 766–68. Beijing: China Transportation and Communications Society.

Zhang Chenshuang. 1996. Strategic choice towards the 21st century for postal and telecommunications sector (in Chinese). In *Yearbook of China transportation and communications,* 543–44. Beijing: China Transportation and Communications Society.

Zhang Xuan. 1991. A discussion of perfecting the economic mechanism of telecommunications enterprises (in Chinese). *P & T Economy* 16 (3): 5–7.

Zhou Zhiqun. 1991. The usage of foreign investment in P & T business (in Chinese). *P & T Economy* 16 (3): 36–37.

Comment Shang-Jin Wei

Ding Lu's trademark is lucidity. In this well-written paper, Lu provides a very informative account of how China's telecommunications industry has developed during the past two decades.

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According to Lu, the Chinese reform has several important features. First, the old central planning system was partially dismantled in the early 1980s. The single Ministry of Posts and Telecommunications has been broken down into several *state-owned* corporations competing with each other. Second, there is virtually no foreign direct investment in the sector.

Lu concludes that the result of the reform is a spectacular improvement in China's telecommunications infrastructure. In fact, China has overachieved its targets set in its five-year plans for every such plan in the past two decades. Using a regression analysis, Lu infers that China's teledensity has evolved from substantially below the world norm relative to its per capita GNP in the mid-1980s to 93 percent above the world norm in 1994.

I have two comments or questions about the paper. First, what is the lesson of the telecommunications sector in China? Second, is China truly an overachiever in teledensity?

Let me start with the first question. It is interesting to compare the telecommunications reform with energy sector reform. The reform measures are apparently similar in the two sectors. Both had what Lu calls "limited deregulation and controlled competition": the production and sale functions of the ministries were converted into a few state-owned corporations; no foreign direct investment was visible. Yet the results in the two sectors are very different: the reform in the telecommunications sector appears successful, while the energy sector is subject to severe shortages, bottlenecking the rest of the economy. Why?

My guess is that the degree of competition makes a big difference. In the energy sector, price remains controlled and the distribution channel remains monopolized. The incentive for private entry into production is not too great. In contrast, in the telecommunications sector, the government has wisely allowed local companies to charge market prices for installation fees, which helps to increase the supply and to equilibrate supply and demand. Maybe partly out of luck, the emerging and quickly booming cellular phone business does not depend on the existing state-owned telecommunications network, so the nature of the technology makes the state monopoly relatively easy to break. The lesson is that deregulating the price system and allowing free entry and more competition should also help the energy and other currently state-monopolized sectors (such as banking).

Let me turn to my second comment on China's teledensity. To see how China's actual teledensity compares to the world norm, Lu uses a two-step strategy. In step one, he runs a regression of teledensity on the level of GNP per capita and uses the fitted value to establish a benchmark. In step two, he compares China's actual teledensity with the prediction of the regression. Using this procedure, Lu infers that China's teledensity has become higher than the international norm.

This inference could be wrong if the benchmark is misspecified. A potential source of misspecification exists: the regression has no intercept. If

the true relationship has a positive intercept, then the true slope would be smaller than what Lu estimated. Since China's per capita GDP is likely below the average in the sample, China's teledensity could be below the world norm in truth while it appears above Lu's estimated line. Therefore, it may make sense for Lu also to report a benchmark regression with an intercept.

Another point: Lu may want to transform per capita GDP into logarithmic form before putting it in the regression. It is my hunch that this would improve the fit of the regression by making the error closer to homoskedasticity. But it can be easily checked.

Comment Tsuruhiko Nambu

The objective of this paper is to inquire into China's secrets or sources of success in building up its telecommunications network so rapidly in the 1980s and early 1990s. Ding Lu gives an excellent description of governmental policies toward the telecommunications industry. The main points are as follows:

Incentive induced investment: This includes the "three 90 percent" rule, the accelerated depreciation rule, and the freedom to set installation fees.
Hierarchical structure of regulatory system: The relationship between the MPT and local governments is structured so that PTAs govern PTEs and PTBs govern local telephone companies.
MPT's strong guidance on unified network construction

The success of the MPT is not surprising to the Japanese because Nippon Telephone and Telegraph, Inc. (NTT) achieved the same thing in the twenty years from 1952 to 1977. During this period, the backlog of telephone installation demand disappeared and direct dialing throughout the country was realized.

But the situation China faces is totally different. In the case of Japan, network construction was done in the 1960s and 1970s when the basic technology was simple: it was wireline technology and few alternatives were in sight. From now on, technology will be diverse and the future is full of uncertainties. The competition between wireline and wireless makes it difficult to guess the future.

The MPT itself faces risks in investing in wireline. Clearly, mobile telephone is emerging as a threat to wireline telephone. Wireline may be efficient as a backbone network, but in local telephony, wireless technology might well be more efficient, especially in the huge country of China.

The future of the telecommunications industry will be dominated by the

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demand side. The essence of telecommunications service lies in interconnection between users. Unlike electricity, users generate their own demand and telecommunications circuits serve only as intermediary equipment. This is becoming more obvious with the recent development of Internet communication.

Although the Chinese government has built its network its own way, Chinese telephone users may also build their own communications network. What is most needed is to restructure and build in mechanisms that are fully adjustable to the shifting demand structure. On the other hand, installation fees are so high that they constitute an important part of the investment fund. What kind of policy measures can be applied to let this fee be reduced to a level affordable to the average customer?

Internet expansion is based on easy access to the network, and future development depends especially on accessibility to the local network. At this moment the nature of competition is changing dramatically from the long-distance market to the local telephone market. It is most important to understand the process by which of local competition emerges and to evaluate the role of government in letting competition loose or forestalling the dynamic competitive process. I will give a brief outline of local loop competition in Japan since the privatization of NTT in 1985.

Competition in the Local Loop

In the early 1980s everyone believed that competition in telecommunications would be limited to the long-distance market and that local telephony would remain monopolistic. This prediction has become groundless since technological innovations have been realized to the extent that the incumbent monopolist has been challenged by newcomers like CATV operators and wireless businesses.

In Japan the Telecommunications Business Law, enacted in 1985, gave the regulatory framework within which competition would be introduced into the telecommunications industry. It is notable that entry into the local market was not restricted by the law, unlike the Modified Final Judgment (MFJ) dichotomy ruling in the United States. The law could be interpreted as saying that any firm could enter the local loop if it could meet the conditions imposed on Type I carriers by Japan's Ministry of Posts and Telecommunications (MPT). Type I carriers are defined as those who own telecommunications facilities for their own use. Because entry into the long-distance market was encouraged by MPT, one could reasonably expect that some firms may have entered providing both local and long-distance services. In reality, it did not happen.

Subsidiaries of electricity companies entered the local markets in their own regulated business areas. Japan has nine electricity companies, which are given the status of local monopolies. They had the capability to challenge NTT, but they encountered two difficulties.

First, MPT did not allow rate rebalancing as was done in the United

Kingdom, and accordingly the local rate was kept intact: NTT could not raise its local rate. This allowed little room for profitable entry into the local market.

Second, the nine electricity companies were already interconnected for the purpose of wheeling their electricity services and well prepared to provide telecommunications services jointly in a technological sense. But they found, or believed they had found, that interconnecting telecommunications services across the country was prohibited by MPT. Not until 1995 did an MPT officer declare from the seat of the Regulatory Reform Committee that MPT had never banned interconnection of telecommunications services among subsidiaries of electricity companies. Indeed, the Telecommunications Business Law contains no formal restrictions on such interconnection.

There then emerged several regulatory disasters that prevented entry or the potential threat of entry into the Japanese local telephone market. First, rate rebalancing was flatly put aside by MPT. The ministry argued that NTT was a fat company and could cope with the problem of cross-subsidy from long distance to local service even when facing competition in the long-distance market. Along with the Telecommunications Business Law, the NTT Corporation Law was enacted, and NTT was made responsible for continuing universal service as it had in the days of public monopoly. The focus was always on whether NTT could be profitable enough to provide universal service. It was the judgment of MPT that NTT could continue to provide universal service by cutting its organizational redundancy, and rate rebalancing was out of the question until MPT found adequate evidence of efficiency enhancement in the NTT corporate structure.

From the social point of view it is difficult to say whether the Japanese approach or the British approach—where British Telecom was given an opportunity for rate rebalancing under a price-cap regime (retail price index minus 3 percent)—was better. But from the viewpoint of an economist, it was necessary to introduce rate rebalancing in order to realize competition and reshape the telecommunications industry as a whole. The problem of an inefficient incumbent monopolist is another issue to be tackled separately. The confusion at MPT between squeezing NTT from a regulatory standpoint and restructuring service prices was a source of delay in attempts to invite local competition.

The second regulatory problem was the Japanese nontransparent, implicit guideline procedure—often called *gyoseishido.* This term was associated with the industrial policy of the Ministry of International Trade and Industry (MITI). No one knows whether this procedure was successful, but MPT seems to have adopted this custom when it began regulating the telecommunications industry. A careful reading of the Telecommunications Business Law was not sufficient to honor the intent of MPT bureaucrats. Other detailed documents were published, and business firms had to

consult with bureaucrats in each section of the ministry when they made business decisions. It is not surprising that electricity companies took for granted that they could not enter local telephony.

Because the local rate was kept unchanged (10 yen per three minutes) the entry of electricity companies was unprofitable, and those companies naturally wanted to enter the long-distance business. They argued for deregulating the telecommunications industry, and the Regulatory Reform Committee gave a formal opportunity for discussing this problem. It was a kind of accident that the MPT top official confessed that MPT did not intend to regulate entry into long distance by electricity companies and that they could be interconnected nationwide.

This episode gives insight into the uncertainties created by the discretion of bureaucrats. If there had existed a transparent guideline, electricity companies and others might have begun to supply full line service or at least might have brought different strategies to the telecommunications business. MPT's implicit policymaking, and its policy agenda subject to no time constraints, constituted another source of delay in bringing about local telephone competition.

Competition among Technologies

Wireline technology used to be regarded, whether coaxial or fiberoptic, as a dominant technology with no close substitute. Quite recently, however, wireless technology has become a challenger to wireline. It was developed mainly in the Scandinavian countries but now has no particular location. The inertia of older telephone subscribers may be the highest barrier to its development, but this resistance will be easily broken in the coming years. Cable television (CATV) providers have become wireline competitors to incumbent telephone monopolists. They can exploit economies of scope in providing broadcasting and telephone services. At the same time computer technology development has made it possible for a small exchange to compete with the local exchange of the incumbent. Satellite is another source of potential competition to the old telephone network. Many problems must be solved for it to become a stable competitor, but its competitive threat is so great as to enhance local as well as long-distance competition.

In the face of these new technical opportunities, institutional architecture plays a decisive role in encouraging competition. The Nordic countries placed no regulation on technology choice, and the evolutional development of the wireless business has been witnessed in the past fifteen years. After the duopoly review in 1991, the British CATV industry experienced rapid growth, and it has become a real threat to the British Telecom telephone network. In the United States, the 1984 act of deregulating CATV relieved CATV operators of providing public broadcasting services and it paved the road to extend its business from broadcasting to telephony.

In Japan MPT was an efficient brakeman to this kind of development. The CATV industry was strictly regulated in several ways:

1. CATV tariffs had to be based on accounting cost and could not be lowered in order to attract new customers. As a result, CATV service was expensive enough to restrict the number of subscribers.
2. CATV used to be defined as a rescue service for broadcasting in a limited area. As public broadcasting it had to observe rules that prohibited entertainment services. Also there existed unprofitable "local content" regulation. The CATV industry was not given business opportunities in general.
3. CATV operators did not have the right of way to access subscribers. This was the greatest obstacle to expanding their businesses.

In 1994 MPT deregulated the CATV industry to some extent. The narrowly defined business areas were relaxed to enable multifranchise operators in certain regions. Foreign capital restraints were lifted to the extent that foreign companies could contribute up to one-third of total capital. But everything came too late. CATV operators are now going to start telephone service under a new regime of interconnection with NTT. It is quite probable that they will become competitors to NTT, but Japanese customers must wait and continue to lose much until local competition emerges.

The experience of the wireless industry gives a clear and simple example how regulation can be a deterrent to the healthy development of telephone business. Until recently there existed price regulation on wireless services: cellular telephone and personal communications services. Their prices used to be too high to attract subscribers. Then a few years ago, MPT lifted these regulations and the wireless markets exploded. This should have been easily anticipated simply because of the examples of many other countries. The Japanese people wasted much time and many resources through untimely regulation.

Uncertainty Created by a Divestiture Argument

In this year the argument over NTT divestiture was settled: NTT should be reorganized as a holding company to which two regional companies (NTT East and NTT West) and one long-distance company belong as subsidiaries.

It was in 1985 that the decision whether to break up NTT was postponed. In 1990 again no conclusion was reached, and the discussion was postponed until 1996. During that period the environment surrounding the telecommunications industry changed completely. The dichotomy between local and long distance has proved meaningless; technology is constantly changing, and no one can foresee the future; bundling or full line

service might be necessary for large operators to survive; entry from other fields like electricity and gas has become a real threat; and so forth.

It appears that MPT paid little attention to these changes and continued to insist upon the necessity of divestiture. Wrong or right, it created great uncertainty about the telecommunications infrastructure. Because holding companies were prohibited by the Antimonopoly Law, it was impossible to imagine NTT as an integrated organization in the name of a holding company. MPT took a political risk by proposing the idea of restructuring NTT as a holding company, along with reforming the Antimonopoly Law.

It may take a few years to reshape NTT, while such countries as the United Kingdom, United States, and Singapore will not miss the opportunity to develop at higher speeds. Japan does not have time to lose. How to deregulate or break up regulations is an urgent issue for the Japanese.

Last, I will touch on the harmonization problem with regard to interconnection and accounting rules. By nature the telecommunications business is global. There is no obstacle to international communications but institutional restraint. Needless to say, interconnection is the key to realizing full competition. In every country now, interconnection rules are being discussed, and in the United Kingdom and United States there have emerged certain proposals to deal with this problem. In Japan the report of MPT on interconnection was recently published.

Each country has its historical background to account for differences in its price structure that cannot be harmonized in the short run. As a starting point, we must have common accounting rules to allow us to understand correctly the financial situation of each country. And based on transparent accounting rules, we can calculate interconnection charges that can be shared among countries.