The Sectoral Foundations of China's Development

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The Sectoral Foundations of China's Development

Shahid Javed Burki and Shahid Yusuf, editors

The World Bank
Washington, D.C.
Foreword

The World Bank's economic and sector work program on China is a very active one ranging over a wide spectrum of topics from macroeconomics to health and education. Each year we publish a handful of our formal studies, but thus far most of the background papers and informal reports, many of them containing valuable analysis and information, have remained outside the public domain. Through the China and Mongolia Department Working Paper Series, we hope to make available to a broad readership among the China watchers and development communities a few of the papers which can contribute to a better understanding of China's modernization.

This volume is, in the best sense of the term, a collective effort. Once it was decided to try and make available to a wider public the fruits of the World Bank's sectoral explorations in China, Gene Tidrick was responsible for the critical first steps down what has proven to be a long road. One by one the various authors, many of whom now preoccupied with countries other than China, were persuaded to return to the scene of earlier jousts and cast a critical and improving eye on their work. Each author rallied to the task and put in the requisite value added. China is changing perhaps more rapidly than most developing nations and a few years is enough to date a manuscript. Where possible, the information has been updated. Messrs. Anthony Ody and Tejaswi Raparla were particularly helpful in this regard. Bruce Ross-Larson offered expert editorial guidance and Ms. Fay Willey did the invaluable editorial spade work. To all of them, as well as the anonymous referees who commented, at times acerbically, on an earlier draft, we extend our thanks.

Shahid Javed Burki
Director
China and Mongolia Department
Asia Region
CURRENCY EQUIVALENTS

FISCAL YEAR
January 1 - December 31

WEIGHTS AND MEASURES
Metric System

ABBREVIATIONS AND ACRONYMS USED

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>AIC</td>
<td>Average Incremental Cost</td>
</tr>
<tr>
<td>Btu</td>
<td>British Thermal Unit</td>
</tr>
<tr>
<td>CMA</td>
<td>Coal Mining Administration</td>
</tr>
<tr>
<td>CRTVU</td>
<td>Central Radio and Television University</td>
</tr>
<tr>
<td>CSC</td>
<td>Changjiang Shipping Company</td>
</tr>
<tr>
<td>ECEPA</td>
<td>East China Electric Power Administration</td>
</tr>
<tr>
<td>f</td>
<td>Fen</td>
</tr>
<tr>
<td>FOB</td>
<td>Freight On Board</td>
</tr>
<tr>
<td>GCC</td>
<td>General Coal Corporation</td>
</tr>
<tr>
<td>GDP</td>
<td>Gross Domestic Product</td>
</tr>
<tr>
<td>GNP</td>
<td>Gross National Product</td>
</tr>
<tr>
<td>HLF</td>
<td>High Load Factor</td>
</tr>
<tr>
<td>ILF</td>
<td>Intermediate Load Factor</td>
</tr>
<tr>
<td>kV</td>
<td>Kilovolt</td>
</tr>
<tr>
<td>kVA</td>
<td>Kilovolt Ampere</td>
</tr>
<tr>
<td>kW</td>
<td>Kilowatt</td>
</tr>
<tr>
<td>kWh</td>
<td>Kilowatt-hour</td>
</tr>
<tr>
<td>LF</td>
<td>Load Factor</td>
</tr>
<tr>
<td>LOS</td>
<td>Length of Stay (in hospital)</td>
</tr>
<tr>
<td>LRMC</td>
<td>Long-Run Marginal Cost</td>
</tr>
<tr>
<td>MOPH</td>
<td>Ministry of Public Health</td>
</tr>
<tr>
<td>MW</td>
<td>Megawatt</td>
</tr>
<tr>
<td>MWREP</td>
<td>Ministry of Water Resources and Electric Power</td>
</tr>
<tr>
<td>OECD</td>
<td>-</td>
</tr>
<tr>
<td>PEP</td>
<td>People’s Education Press</td>
</tr>
<tr>
<td>PTVU</td>
<td>Provincial Television University</td>
</tr>
<tr>
<td>SEDC</td>
<td>State Education Commission</td>
</tr>
<tr>
<td>SUS</td>
<td>?? para. 3.30</td>
</tr>
<tr>
<td>SVS</td>
<td>Vocational Agricultural School</td>
</tr>
<tr>
<td>SWS</td>
<td>Skilled Workers’ School</td>
</tr>
<tr>
<td>tce</td>
<td>ton of coal equivalent</td>
</tr>
<tr>
<td>TVCE</td>
<td>Township and Village Collective Enterprise</td>
</tr>
<tr>
<td>TVE</td>
<td>Township and Village Enterprise</td>
</tr>
<tr>
<td>TWh</td>
<td>Thousand Watt-Hours</td>
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<td>Volt</td>
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<td>XHS</td>
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Colin J. Warren

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An Overview of Sectoral Development in China

by Shahid Yusuf and Shahid J. Burki

i. China's development record over the 1980s has few rivals. Many explanations have been rehearsed, but the role of sectoral policies have received insufficient notice. The purpose of this volume is to draw sectoral contributions closer to the center of the stage; to underscore the importance of investment in infrastructure, education and services during the three decades following Liberation; as well as the continuing attention received by these sectors in the 1980s; and the importance of meshing macroeconomic with sectoral strategies if China is to double its GDP during the decade of the 1990s.

China's Development: The First Three Decades

ii. After gathering the reins of power in 1949, the Communist government immediately set about consolidating its political authority and resuscitating an economy scarred by nearly two decades of intermittent strife. Much of China's industrial base in Manchuria and along the East Coast had been severely damaged. What remained of its limited transport infrastructure was in a state of disrepair. The urban housing stock, power generating facilities, irrigation facilities, all had endured serious blows. The harm to physical facilities was not the only setback; the education system, which had begun preparing China's largely illiterate populace for the challenges posed by a modernizing economy, was also gravely disrupted. Over the three decades much energy was devoted towards the rebuilding and progressive deepening of the industrial base, developing of the transport infrastructure, and raising the quality of the workforce through investment in education as well as health care services.

iii. Between 1953 and 1978, industrial output rose at an annual average rate of 11.4 percent (Table 1). This figure conceals certain features of industrialization which are in sharp contrast to those observed in other developing countries. First, by embracing the Soviet model of industrialization, China focused much of its efforts on industries producing steel, machinery, petrochemicals and basic materials and, by the mid-1960s, a near parity was achieved between heavy and light industries. This strategy, orchestrated through central planning, pushed the demand for transport and energy per unit of industrial production far above the level for most other developing countries, where the less resource-intensive light manufacturing and service sectors tended to be dominant. Low state-determined prices for railway freight, coal and electricity, together with the reliance on relatively outdated Soviet or indigenous technologies, also resulted in the inefficient use of scarce inputs. Second, manufacturing centers were dispersed throughout the country, some to quite remote areas, partly for strategic reasons, partly also to ensure that all segments of the country and not just the historically favored northeastern coastal region benefitted from progress; and, third, China funneled much of its industrial capital into medium- or large-scale plants to the neglect of smaller, labor-intensive manufacturing facilities catering to rural and urban consumers.
Table 1: MACRO INDICATORS  
(In million yuan)

<table>
<thead>
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<th>1952</th>
<th>1978</th>
<th>Annual growth 1953-78 (%)</th>
</tr>
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<tbody>
<tr>
<td>GNP</td>
<td>-</td>
<td>250.2</td>
<td>-</td>
</tr>
<tr>
<td>Total social product</td>
<td>2,105.3</td>
<td>289.9</td>
<td>7.9</td>
</tr>
<tr>
<td>Industrial output</td>
<td>5,525.4</td>
<td>333.1</td>
<td>11.4</td>
</tr>
</tbody>
</table>


iv. Having adopted the Soviet model for industry, it was almost inevitable that China would also opt for a transport system heavily dependent on railways to satisfy industry's demand for fuel and bulky raw material. The country's difficult geography, the location of raw materials, particularly coal, the size of major steel and machinery plants and the siting of the new industrial complexes in the interior of the country, all tended to reinforce the attractions of railways. But the preference for provincial or at least regional autonomy means that transport did not receive the attention it deserved and little attention was given to creating a multi-modal network, sufficient to integrate the national economy. China's railroad network, a mere 21,800 km in 1949 1/ much of it located in the northeast, was gradually expanded to 48,600 km by 1978. Intensive utilization made it possible to increase the freight carried by nearly 9 percent per annum over this period, but much of the additional capacity built during the 1950s and 1960s was in the interior—the Sichuan-Guizhou line, the Yunnan-Guizhou line and the Chengdu-Kunming line—which did little to alleviate the congestion along the eastern corridor.2/ The navigable inland waterway system was expanded from 74,000 km in 1949 to 162,000 km in 1962, but thereafter, a significant part was lost through siltation and the construction of dams without shiplocks. The focus on railways, the persistent backwardness of the auto sector, as well as the cost of building and maintaining an all-weather highway network, held back attempts to augment road transport capacity: the length of the road system went from 80,700 km (1949) to 890,200 (1978), but most of it was unpaved. Freight transported, starting from a small base, climbed at an annual rate of 12 percent (Table 2) but relative to the size of the economy and the population base, its contribution lagged behind China's comparators.

v. In the early 1950s, a little more than half the eligible cohort was enrolled in primary schools; and the size of the student body in tertiary institutions was under 200,000. Through forced marches, spearheaded by nationwide campaigns, there was a threefold increase in attendance at primary

1/ At the time of liberation, half of the network was unusable.

2/ The share of railway kilometrage in the central and border provinces rose from 12 percent in 1949 to 36 percent in 1970.
Table 2: TRANSPORT SECTOR FREIGHT TRAFFIC

<table>
<thead>
<tr>
<th></th>
<th>1952</th>
<th>1978</th>
<th>1988</th>
<th>Growth rates (%)</th>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(annual average)</td>
</tr>
<tr>
<td>Railways</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Million ton-km</td>
<td>60,200</td>
<td>534,500</td>
<td>987,800</td>
<td>8.8 6.3</td>
</tr>
<tr>
<td>Million passenger-km</td>
<td>20,100</td>
<td>109,300</td>
<td>326,000</td>
<td>6.7 11.5</td>
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<tr>
<td>Highways</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Million ton-km</td>
<td>1,400</td>
<td>27,400</td>
<td>32,200</td>
<td>-</td>
</tr>
<tr>
<td>Million passenger-km</td>
<td>2,270</td>
<td>52,100</td>
<td>252,800</td>
<td>12.8 17.1</td>
</tr>
<tr>
<td>Waterways</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Million ton-km</td>
<td>14,600</td>
<td>377,900</td>
<td>1,007,000</td>
<td>13.3 10.3</td>
</tr>
<tr>
<td>Million passenger-km</td>
<td>2,450</td>
<td>10,100</td>
<td>20,400</td>
<td>5.6 7.3</td>
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<td>Civil aviation</td>
<td></td>
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</tr>
<tr>
<td>Million ton-km</td>
<td>-</td>
<td>100</td>
<td>730</td>
<td>20.9 22.6</td>
</tr>
<tr>
<td>Million passenger-km</td>
<td>20</td>
<td>2,800</td>
<td>21,400</td>
<td>- 22.0</td>
</tr>
</tbody>
</table>


schools (146 million or 94 percent of the eligible age group). Higher institutions also enlarged their enrollment to 856,000, but it remained tiny in the face of China’s immensity (Table 6).

vi. Towards the end of the 1940s, civil war had reduced the health care system to a shambles. Its rebuilding took many years and the success at beating back infectious diseases, reducing infant mortality and extending life expectancy was a function no less of the skill at organizing communities to practice preventive medicine as it was the ability to multiply the number of hospital beds (from 160,000 to 1.85 million) and train an adequate number of medical personnel (690,000 to 2.5 million) (Table 3). By inducing people to boil water, by imparting simple techniques of sanitation, by successful, generally labor-intensive assaults on disease vectors, and by means of widespread inoculation campaigns, China’s public health apparatus dramatically changed the epidemiological profile.

vii. Although progress was somewhat uneven, China did succeed in establishing the necessary foundations for its transport infrastructure and social services. To have done this in the space of less than 30 years was noteworthy not just because the country was able to raise itself by its own bootstraps after having experienced deep economic wounds. Equally significant was the doggedness with which momentum was sustained in spite of extraordinary setbacks inflicted by the Great Leap Forward (1958-60), the Cultural Revolution (1967-70) and the Third Line Strategy (1965-71). The latter swallowed capital amounting to billions of yuan in an ambitious effort to make individual
Table 3: HEALTH INDICATORS

<table>
<thead>
<tr>
<th></th>
<th>Unit</th>
<th>1952</th>
<th>1978</th>
<th>1988</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beds in the Hospital</td>
<td>Million</td>
<td>0.16</td>
<td>1.85</td>
<td>2.50</td>
</tr>
<tr>
<td>Medical Personnel</td>
<td>Million</td>
<td>0.69</td>
<td>2.46</td>
<td>3.72</td>
</tr>
</tbody>
</table>


Chinese provinces largely self-sufficient in the event of an invasion. There can be little doubt that China's unique adaptation of the Soviet model of central planning yielded results even though the allocative mechanism employed was prodigal with domestic resources, and imposed a regimen of extreme frugality far longer than was warranted. China's progress since the diffusion of reforms starting in 1978/79 has rightly received much favorable acclaim. But the shift in growth trends, which occurred in the late 1970s--from about 7-8 percent per annum during 1953-78 to over 9 percent over the period 1979-88--would have been impossible were it not for the physical and social infrastructure created at great cost over three decades and a significant improvement in China's human resources. By preparing the ground, it dramatically telescoped the time required by the seeds of reform to germinate and to sprout.

Post-Reform Sectoral Trends

viii. Following the change in leadership during the mid-1970s, the awareness grew that China was lagging far behind several of the rapidly modernizing nations of East Asia. Centralized planning constrained growth in productivity and autarkic policies prevented China from using trade, foreign capital and technology to benefit its economy. The pricing regime followed blunted incentives, aside from distorting resource allocation, while the ownership forms in place curbed initiative and effort. After a spell of low-keyed experimentation during 1976-78, reforms were introduced in the rural sector, which by slow degrees transferred the locus of decision-making from communes to farm households, gave farmers 15- to 30-year leases on their land, permitted them to trade above-quota grain plus other products on free markets, and brought about a major shift in relative prices in favor of the agricultural sector. Rural reforms not only galvanized farming activities, they also slipped rural industry off the leash. In an astonishingly brief span of time, a crowd of collective, cooperative and individually owned enterprises sprang into existence, particularly in the coastal provinces, to meet a host of long-suppressed consumption wants (Table 4).

ix. Once the household responsibility system and its associated contracting, marketing and pricing arrangements had been tested in the primary sector, a second, more difficult phase of urban-industrial reforms began in the early 1980s and gathered momentum after 1984. Again, the stress was on decentralized management, greater enterprise autonomy and an enlargement of the freedom to trade in quasi free markets governed by a complex regime of
Table 4: TOWNSHIP AND VILLAGE ENTERPRISES IN 1988
IN THE INDUSTRY SECTOR

<table>
<thead>
<tr>
<th>Enterprises</th>
<th>Employment (million)</th>
<th>Gross Output (Million Y)</th>
<th>% Share of Total GVIO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Township Enterprises</td>
<td>0.24</td>
<td>14.95</td>
<td>184,669</td>
</tr>
<tr>
<td>Village Enterprises</td>
<td>0.73</td>
<td>18.42</td>
<td>170,363</td>
</tr>
<tr>
<td>Joint Rural Enterprises</td>
<td>0.69</td>
<td>/a</td>
<td>40,011</td>
</tr>
<tr>
<td>Rural Individual Enterprises</td>
<td>5.70</td>
<td>21.96</td>
<td>72,200</td>
</tr>
<tr>
<td>Total</td>
<td>7.36</td>
<td>55.33</td>
<td>467,243</td>
</tr>
</tbody>
</table>

/a 21.96 for Rural Individual and Joint Rural combined.


Free, fixed and guided prices. Decentralization would not have been meaningful without some devolution of the control exercised by the center over fiscal resources. Thus reform was paralleled by a reapportionment of fiscal revenues and enterprise profits, which reduced the central government’s revenue to GDP ratio from over a third in 1978 to a little over a fifth by 1988.

Perhaps because of the intensive investment which preceded it as well as the latent energies that were stored in the lower reaches of the provincial organizations, China’s economic performance through much of the 1980s outclassed most other developing countries. The indicators presented in Tables 2, 5, and 6 testify to the ascent of the GDP and its major components. They also draw attention to the quickening in some instances of sectoral trends in education and transport supportive of China’s efforts to modernize and to prosper. As China crosses the threshold into the 1990s and hitches the economy to the shafts of the Eighth Plan, a searching glance over the preceding 12 years can be invaluable in identifying the varying levels of sectoral capability and shaping policies for the future.

Sectoral Constraints and Future Development

By decentralizing economic management, circumscribing the role of the Plan and permitting economic entities spanning a variegated spectrum to retain resources which were once transferred to Beijing, China’s reforms enabled the economy to exploit some of the potential accumulated through decades of sedulous investment. Although investment rose to new peaks (an average of about 35 percent of GDP during 1980-88), there were, in addition, substantial gains in consumption for rural and urban inhabitants alike. Within a handful of years, small-scale manufacturing and service enterprises, whose numbers had been deliberately held in check, emerged as important sources of growth, of employment, and of export (Chapter 1). They enriched the domestic market by making available myriad products which greatly widened...
### Table 5: MACRO INDICATORS

<table>
<thead>
<tr>
<th></th>
<th>Growth Rates</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1978-88</td>
<td>1988</td>
</tr>
<tr>
<td>GDP</td>
<td>9.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Industry</td>
<td>11.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agriculture</td>
<td>5.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Percentage Shares to GDP</td>
<td></td>
<td>34.4</td>
<td>34.3</td>
</tr>
<tr>
<td>Gross Domestic Investment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gross Domestic Savings</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


The consumption opportunities of the average households. Towards the end of 1988, the so-called TVCEs numbered nearly 19 million (of which 7 million in industry), employed 95 million people (of which 55 million in industry), contributed nearly a quarter of industrial output and, with a few billion dollars worth of exports, were emerging as a force in the trading sphere (Table 4).

### Table 6: EDUCATION INDICATORS

<table>
<thead>
<tr>
<th></th>
<th>Unit</th>
<th>1952</th>
<th>1978</th>
<th>1988</th>
</tr>
</thead>
<tbody>
<tr>
<td>School-age Children</td>
<td>Million</td>
<td>66.42</td>
<td>121.31</td>
<td>96.24</td>
</tr>
<tr>
<td>School-age Children Enrolled in Schools</td>
<td>Million</td>
<td>32.68</td>
<td>115.85</td>
<td>93.51</td>
</tr>
<tr>
<td>Enrollment Rate (%)</td>
<td>Z</td>
<td>49.2</td>
<td>94.0</td>
<td>97.2</td>
</tr>
<tr>
<td>Adult Literacy</td>
<td>Z</td>
<td></td>
<td></td>
<td>78.0</td>
</tr>
</tbody>
</table>


Having greatly attenuated the threat from infectious diseases and largely jettisoned the organization of social services within the commune framework, China began reorienting health care towards curative facilities equipped to treat chronic diseases, the principal killers (Chapter 6).
consequences were somewhat ambiguous: real per capita expenditure on health rose by 11 percent per annum during 1980-88 as against GDP growth of 8.7 percent, but more of the resources were absorbed by a relatively small number of urban patients receiving the capital- and care-intensive therapy appropriate for sufferers from cancer and heart disease. Public subsidies for health were reduced and the level of cost recovery by 1988 was 82 percent compared with 71 percent in 1980. Hospital beds increased but at a slower rate than in the past; more doctors joined the ranks, but there was a sharp decline in the number of paramedics, especially barefoot doctors; and there was a perceptible slackening in the practice of preventive medicine in the rural areas, together with a possible retrogression in the access to care by the poor. The 1980s were a time of small advances in life expectancy--to 70 years in 1988--improvements in infant mortality--to 31 per thousand by 1988; of uneven progress in morbidity; and a vastly better understanding of the nation's epidemiological profile, the result of surveys conducted on a truly heroic scale. Towards the end of the eighties, a little over 3 percent of China's GDP was being absorbed by health care but this could rise very steeply in the years to come unless public health services can be mobilized to control smoking and guide nutritional and living habits.

xiv. At the start of the decade, the average living space per capita was a spartan 4.2 m². Reforms took the brakes off housing investment and, by 1985, over 7 percent of GNP was being invested in housing. Between 1985 and 1989, China added an unprecedented 1 billion m² per year in housing space, raising per capita availability nearly 50 percent by the close of the 1980s. Unfortunately, urban services, intracity transport and other infrastructure have lagged behind as have regulations governing land use. China's population may now be better housed (Table 7), but it lacks essential amenities and the problem of overcrowding of environmental pollution have, if anything, become worse (Chapter 2).

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Housing investment as a proportion of GNP</td>
<td>1.50</td>
<td>2.01</td>
<td>6.89</td>
<td>7.71</td>
<td>7.61</td>
</tr>
<tr>
<td>Housing dwelling units completed (million)</td>
<td>1.67</td>
<td>2.12</td>
<td>10.11</td>
<td>15.69</td>
<td>13.97</td>
</tr>
<tr>
<td>Housing floor area completed (million m²)</td>
<td>100</td>
<td>134.5</td>
<td>758.2</td>
<td>1,176.6</td>
<td>1,048.0</td>
</tr>
</tbody>
</table>

Source: Center for Policy Research, Ministry of Construction.

xv. The unexpected strength of the growth surge during 1984-88 quickly absorbed whatever little slack existed in the transport system and the new capacity coming onstream. Although double-tracking, some electrification and the construction of new railway lines had continued during the 1980s, it proved to be insufficient. The development of road and air transport was much
swifter in response to new exigencies and a recognition of the constraints
impinging on the two older, more established modes. In spite of this, the
transport sector struggled to meet demand in the second half of the 1980s,
when GDP growth soared to 11 percent per annum (1985-88), far in excess of
planned targets (see Chapter 7 for the role of waterborne transport).

xvi. Having pushed the production of coal, petroleum and electricity to
fairly high levels during the 1960s and 1970s, China found it difficult to
sustain earlier double-digit growth rates. In the absence of major new dis-
coversies and confronted with high exploration costs, the increase in petroleum
production fell below 3 percent per annum. Coal did better, in part because
small-scale (but inefficient) nonstate mining enterprises proliferated. But
even in the case of coal, the sheer cost of developing large mechanized opera-
tions by the 600 state-owned mining firms permitted coal supplies to increase
annually by only 4.7 percent on average. Electricity generation progressed on
a faster track compared to the other two, although at 7.8 percent per annum it
was half the rate registered during the preceding period (Table 8).

<table>
<thead>
<tr>
<th>Table 8: ENERGY SUPPLIES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>1952</td>
</tr>
<tr>
<td>-------</td>
</tr>
<tr>
<td>Coal (millon tons)</td>
</tr>
<tr>
<td>Crude oil (thousand tons)</td>
</tr>
<tr>
<td>Electricity (million kWh)</td>
</tr>
</tbody>
</table>


xvii. Moderately rising energy supplies, coupled with advances in energy
efficiency induced by modernizing technology and by price reforms (Chapters 8
and 9), allowed industry to survive on a lean energy diet. To a large extent,
energy conservation was the result of advances in technology and price reforms
that forced industrial users to purchase increasing amounts of their require-
ments at market-determined prices. By the late 1980s, however, energy demand
had begun to press against the limits of availability. Stringent rationing
was being enforced in virtually all provinces and industrial plants across the
country lay idle for several days each week for want of electricity
(Chapter 9).

A Sectoral Agenda for the Future

xviii. Much has been made of skill, infrastructure, energy and housing
shortages, especially in the latter half of the 1980s. Certainly many defi-
ciencies were perceived with important implications for the future, but
China's performance, to a degree, belies these complaints. By using price
reform to trim energy and transport coefficients, by utilizing more fully the
capacity created in the prereform era, and by successfully expanding it in
line with Seventh Plan targets, China was able to sustain a rate of growth far
above what had been anticipated for most of the 1980s. However, by 1988, the
evidence of overheating could no longer be ignored. Not only did the government employ deflationary policies to bring GDP growth down to a more sedate 4-5 percent, it reached back for the administrative mechanisms of centralized resource allocation to direct resources into sectors whose output appeared to fall short of expected needs.

xix. Transport and energy are to receive more generous allotments of capital during the Eighth Plan (1991-96). After some hesitation during 1989/90, the authorities have reiterated their commitment to the TVCE sector, realizing that the dynamism they have injected into the economy outweighs some of the inefficiencies associated with production on too small a scale, duplication, demand pressure for credit and environmental pollution. TVCEs need regulation, but they are too important a force to be severely curbed. Additional funds for education, which would push its share of GDP above the current 3.3 percent, are unlikely to be forthcoming. But the belief in education as a modernizing force is deep-seated. Within the next 10 to 15 years, China expects to universalize nine years of education and, where necessary, to equip secondary-school graduates with practical skills through vocational training. Teachers and facilities are so inadequately utilized and so much squandered on administrative expenses that China can certainly expect to reach a higher output as well as higher scholastic standards without additional expenditures, if there is a will to introduce reforms which are sure to rouse bitter opposition from education establishment.

xx. A supply-side approach that widens the channels for economic activity in a manner somewhat similar to the pre-1978 investment push has its merits, but it must be complemented by price reforms to maximize productive efficiency. More than half of all goods and services were being traded at market-guided prices by the end of the 1980s. On the margin, a majority of decisions are being made with reference to underlying real scarcities. This sea change in the allocative process has nudged the economy closer to the productive frontier, but so far only a fraction of potential gains have been realized. Inefficiencies in transport and energy use are still very noticeable, in large part because a substantial volume of such inputs are allocated to users at low prices fixed by the state. An extension of price reforms, which enlarges the ambit of market pricing, would ensure that existing supplies and the additions to come are put to the best possible use.

xxi. In capsule, by giving freer rein to entrepreneurial energy, China can continue to reap benefits from buoyant TVCEs. Tactful regulation can ensure that diseconomies are held in check. Increasing the share of investment in transport, energy and urban infrastructure can stimulate the productive sectors and improve the quality of life in China's expanding cities. The economy's resources will be most effectively utilized if those who make decisions and others who are a part of the production chain possess skills of the highest order: labor must be well trained and enjoy good health. To cap all this, China requires to complete price reforms that will put the finishing touches to a market environment in which allocative decision-making can be powerfully buttressed by optimal prices.

xxii. This is the thematic axis around which all nine papers turn. They are based on lengthy technical reports prepared between 1984 and 1988. All have been updated and their messages scrutinized from the vantage point of the early 1990s. It is only because the analysis as well as the recommendations
pass muster that we have brought them together in this volume. There is no shortage of volumes on China's recent development, but most of these are pitched at a macro level and tend to skate quickly over the essential sectoral building blocks. Textbooks, vocational education, power pricing, the use of coal, water borne transport and Zhejiang's efforts to surmount the travails of urbanization are the critical but unseen determinants of China's development. Lacking the high profile enjoyed by macro variables, they are to be found, if at all, sequestered in footnotes or between the covers of formidably dry, specialized treatises. Ideally, the sectoral foundations story should be presented in a thematically tight and comprehensive manner: all transport modes and not just waterways; petroleum and electricity alongside coal and so on. But we hope that these partial accounts, nevertheless, provide a fresh perspective on China's development and usefully augment the policy agenda for the 1990s.
I. RURAL COLLECTIVE AND PRIVATE INDUSTRY

1.1 Over the past decade, industrial and other nonagricultural activities have grown with unusual rapidity in rural China. This surge has come because Chinese leaders have reversed some long-standing policies. Ideological and political prohibitions no longer restrict the rural population to agricultural activities. The production responsibility system which replaced the old commune system--has yielded tremendous results. Rural industries are now responsible for the bulk of incremental output and income in the countryside. Increasingly, they help meet rising demand for a whole range of industrial goods. But despite their impressive performance, rural industries will face fresh problems in the 1990s. If they are to continue to grow, they will require further creative policy-making by China's government.

A. Evolving Patterns

1.2 Until the late 1970s, China based its industrialization on a combination of economic strategy and strict constraints. Certain features resembled the Soviet model. There was high investment and emphasis on heavy industry at the expense of light industry and consumer goods. The government planned and directed production and resource allocation. The state owned all sizable firms.

1.3 China was very different from the Soviet Union, however. Its economy and infrastructure were far less developed, its rural population was huge--and its leader, Mao Zedong, had an ideology of his own. As a result, China's industrial model largely differed from the Soviet model in:

- Elimination of material incentives (no bonuses for workers, no profit retention by enterprises).
- A cruder planning apparatus.
- A decentralized industrial administration (even large enterprises nominally reported to provinces and municipalities).
- Decentralized planning and control over goods allocation.
- A tendency toward provincial and local self-sufficiency and autarky.
- Immobility enforced by means of household registration and urban food rationing.
- Restrictions to prevent rural residents from engaging in nonagricultural activities--particularly industry.

1.4 These features had important implications for the pattern of industrialization. Insulation brought an almost caste-like polarization between the urban and rural populations. Urbanites could count on employment, for the most part in the state sector, and a comprehensive set of subsidies and benefits. Peasants lost the bulk of their productive assets (land and implements) and were largely prohibited from working in nonagricultural activities.
1.5 Rural industrialization took place in an administrative straitjacket, albeit one that was loosened on occasion. The pressures of surplus agricultural labor and a government desire to promote rapid development led to several waves of rural industrial change/progress. One wave occurred as part of the Great Leap Forward in 1958 and was a disastrous failure; the bulk of rural factories and workshops created at that time closed down in the early 1960s. A second wave occurred as part of the campaign to promote agricultural mechanization in 1970. It spurred rural industrial growth, but only in certain parts of the country (southern Jiangsu province, for example, on the peripheries of large cities). Though rural areas in principle could develop only agricultural-support industries such as machinery and fertilizer, the more intrepid ones moved into more profitable activities, even subcontracting parts and products for urban factories. This prereform development laid the foundation for a subsequent take-off in the lower Yangtze valley, the Pearl River delta, and a few other areas with proximity to urban markets, a rich agricultural base, and a core of entrepreneurs and skilled workers. Throughout this period, community governments owned all rural industries.

1.6 Since the late 1970s, China has embarked on a different course. The government erased ideological and political prohibitions against rural non-agricultural activities in 1978; it subsequently encouraged private activities. In 1987, it lifted limits on the size of private firms (a ceiling of seven nonhousehold employees). New patterns and models of rural industrialization soon developed. Today, the traditional model based on community-owned firms is only one of several prototypes. Ownership forms include collective and community ownership, partnerships, individual proprietorships, and joint ventures. Markets have become increasingly important in the distribution of goods.

1.7 Rural industry has thrived by taking advantage of the increased scope for market activities and the slower response of the state sector to new opportunities. It also has benefited from tax advantages and, since 1984, enhanced access to credit from the state banking system. Rising rural income and sharp increases in bank credit, along with the enterprises' internal accumulation of capital, have financed rapid expansion.

1.8 Dramatic changes in rural policies and institutions have unleashed rural enterprises on the supply side, but the demand side has also played a critical role. The state sector left numerous vacuums in existing demand that provided an opening for firms. Rising personal income nationwide generated strong pressure for consumer goods and residential construction. Reforms that allowed state firms to procure their own inputs also created a need for goods. In responding to demand from all these sources, rural enterprises have been quicker and more flexible than state enterprises.

B. Recent Growth Performance

1.9 In output, employment, assets, and profits, the growth of rural industrial enterprises has been spectacular during the last decade. Rural gross industrial output rose 30 percent a year (nominal) from 1980 to 1989. The nonagricultural labor force in rural areas (industry, construction, transportation, and commerce) grew 12 percent annually from 1980 to 1989, a total
increase of 187 percent, or nearly 40 million people.1/ Township and village enterprise wages, assets, profits, and tax payments all increased rapidly, reflecting the growth of output and employment, though profits rose more slowly.2/ While the number of new community-owned firms has increased gradually, that of new private-sector firms has soared.

1.10 The dramatic changes in the composition of gross output in rural areas appear in Table 1.1. The share of crop cultivation dropped from half in 1980 to a quarter in 1989; the share of other agricultural activities remained constant; industry rose from less than a fifth to over two fifths. Construction, transportation, and commerce rose modestly as a share of the total, indicating there is still much potential for future gains.

1.11 Shifts in the structure of the rural labor force have also been significant. Cultivation declined sharply in 1984 and 1985, but much of the slack was taken up by agricultural sidelines, which more than doubled their share. The proportion of the rural labor force engaged in industrial activities rose only modestly (from 6 percent in 1980 to 8 percent in 1989), but construction, transportation, and commerce rose from 1.4 percent in 1980 to 6.8 percent in 1989. Overall, the movement of labor out of agriculture has only begun. Nearly four-fifths of the rural labor force is still engaged in agriculture and sideline activities.

1.12 As rural enterprises have become increasingly important, they have generated rising fiscal revenue in rural areas and higher incomes for rural residents. In 1989, township and village collective firms paid over Y 27 billion in taxes, compared with agricultural tax revenues of Y 8 billion. Tax payments have been rising sharply as earlier exemptions are gradually phased out, though special treatment remains common and private firms in particular can evade much of their tax liability. This sector probably is still more lightly taxed than the state sector (though the difference is reduced if extrabudgetary remittances are factored in), but its tax burden is much heavier than the agricultural sector's. In 1989, wage payments by township and village collective enterprises amounted to Y 58.1 billion. If distribution of TVE profits is also included, average payments per head of the rural popula-

---

1/ These calculations are based on China's official rural labor force statistics, compiled by the State Statistical Bureau, which appear to seriously underestimate the number of people involved in part-time or seasonal off-farm activities and those employed by very small firms. According to the figures compiled by the Ministry of Agriculture, the total number of nonagricultural employees (including part-time and seasonal workers) rose from 22 million in 1978 to 77 million in 1986, and 89 million in 1989.

2/ Average wages in township- and village-owned enterprises rose far more rapidly than in state enterprises in 1980-83 (11 percent per year versus 3 percent per year), but this pattern was reversed in 1983-86, when local enterprise wages increased by 14 percent a year and state enterprise wages by 18 percent. During 1986-89, average TVE wages have risen by 15 percent a year, but, because productivity growth has risen more slowly, profit margins have remained fairly narrow, and especially so during 1989/90, a period of slower growth and higher capital costs.
Table 1.1: COMPOSITION OF RURAL GROSS OUTPUT VALUE, 1978-89

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Rural total gross social product /a</td>
<td>203.8</td>
<td>279.2</td>
<td>506.8</td>
<td>634.0</td>
<td>755.4</td>
<td>943.2</td>
<td>1,448.0</td>
</tr>
<tr>
<td>Shares in Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crop cultivation</td>
<td>52.6</td>
<td>49.3</td>
<td>43.3</td>
<td>36.0</td>
<td>33.1</td>
<td>30.1</td>
<td>25.4</td>
</tr>
<tr>
<td>Forestry, livestock, fishery, and sidelines</td>
<td>16.0</td>
<td>19.5</td>
<td>20.1</td>
<td>21.1</td>
<td>20.0</td>
<td>19.5</td>
<td>19.7</td>
</tr>
<tr>
<td>Industry</td>
<td>19.4</td>
<td>19.5</td>
<td>22.9</td>
<td>27.6</td>
<td>31.5</td>
<td>34.8</td>
<td>40.7</td>
</tr>
<tr>
<td>Construction, transport, and commerce</td>
<td>12.0</td>
<td>11.7</td>
<td>13.7</td>
<td>15.3</td>
<td>15.4</td>
<td>15.6</td>
<td>14.2</td>
</tr>
</tbody>
</table>

/a In current prices. Includes agriculture, industry, construction, transport, and commerce.


...
Table 1.2: OWNERSHIP STRUCTURE OF CHINESE INDUSTRY, 1971-89
(percentage of total industrial output value)

<table>
<thead>
<tr>
<th>Year</th>
<th>State</th>
<th>Urban collective</th>
<th>Urban individual</th>
<th>Urban other</th>
<th>Rural nonstate</th>
<th>Of which:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1971</td>
<td>86.9</td>
<td>10.9</td>
<td>-</td>
<td>-</td>
<td>3.2</td>
<td>Township</td>
</tr>
<tr>
<td>1975</td>
<td>81.2</td>
<td>13.7</td>
<td>-</td>
<td>-</td>
<td>5.1</td>
<td>Village</td>
</tr>
<tr>
<td>1978</td>
<td>77.6</td>
<td>13.7</td>
<td>0.0</td>
<td>0.6</td>
<td>8.7</td>
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Note: Percentages for 1971-80 are based on industrial output value figures in 1970 constant accounting prices, for 1981-83 in 1980 constant prices, and for 1984-87 in current prices. Since these figures are based on data compiled by the State Statistical Bureau, they show slightly lower TVE shares than Ministry of Agriculture statistics would imply.


C. Institutional Framework

1.15 A framework of community governments binds together China's rural economy. The township--formerly the commune--is the lowest rural government level; a typical township holds 15,000 to 30,000 people. The village--formerly the brigade--is not a separate level of government but has official functions and a community structure. The production team--about 30 households--is a purely community structure that has lost most administrative functions. Among the communities, there are substantial variations in size and economic power. In Nanhai county, Guangdong province, the average township in 1986 had more than 50,000 people and a gross industrial output of more than Y 35 million, giving residents Y 1,029 in annual per capita income. In Shangrao county, Jiangxi province, the average township had only 20,000 people and gross industrial output of Y 393,000, thus per capita income of Y 322.

1.16 A strong element of rural continuity derives from immobility, despite some loosening at the margins. There is considerable separation between administratively designated urban and rural areas, even though many of the latter are industrializing and urbanizing. The burst of industrialization has resulted partly from regulations that constrain migration to the cities.
But the remaining barriers between urban and rural economies also help explain why the urban state industrial sector has reacted only slowly to competition from rural industry.

1.17 To a considerable degree, rural communities are financially self-reliant. To meet public expenditure needs, most townships depend heavily on revenues from local businesses in the form of profit remittances and various "management fees." Even poorer, more backward communities that receive fiscal subsidies count on the community government and its subordinate economic entities for additional funds. Banking reforms have tied lending ceilings in townships to local deposit generation. Thus, a township's financial position affects even the capacity to borrow funds.

1.18 Community governments have complex--often conflicting--roles and responsibilities. They function essentially as mini-states, providing a range of public and social services and setting policies and regulations within their jurisdictions. They also serve as profit-oriented business entities supervising rural enterprises. They own companies and allocate government funds. They exercise considerable influence over the lending decisions of the local banking system and thus can encourage and support specific privately owned enterprises. They cannot, however, use certain policy instruments normally available to states. They cannot engage in deficit financing: their expenditures must not exceed available funds (including transfers from higher levels of government and profits and taxes from local firms allocated to them). There are also limits on how far these bodies can intervene in imposing barriers to trade in goods, so as to protect their own enterprises from outside competition, although they have tended to become far more aggressive during the economic downturn which began in mid-1989.

1.19 In addition, community government officials tend to be intimately involved in enterprise investment decisions, including changes in product lines, managerial appointments, and levels of wages and bonuses. Community governments also can play a crucial role in risk absorption, investment financing (both directly and through arranging loans), and the representation of their enterprises in an often hostile administrative environment.

1.20 The combination of strong fiscal and employment incentives for community governments, their business development role, and the market environment have generated an extremely powerful push for rural development.

D. Variations in Rural Enterprise Development

1.21 China's richest, most industrialized counties have largely achieved the equivalent of middle-income status. The most backward areas are poor and

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3/ Management fees do not represent payment for services provided; rather, they are often ad hoc levies by community governments that occur outside the budget. Local businesses also generate the lion's share of budgetary tax revenues in the more industrially developed rural communities.

4/ Though there are large gaps between the two (positive and negative) in many localities, incremental loans to a large extent depend on incremental deposit generation.
far less industrialized. The former face issues of how to organize, finance, and develop rural enterprises, while the latter strive merely to begin non-agricultural development. A brief look at five communities will illustrate the extent of local diversity.

1.22 Wuxi county in Jiangsu province has long been China's most industrialized rural county, though it is not the most urbanized. Wuxi is also the quintessential example of traditional township and village enterprise development. Industry is highly efficient in the Chinese context; community enterprises are relatively large and many use quite advanced technology to compete effectively with state industry. Privately owned firms suffer from administrative restrictions. Neither labor nor land markets have developed, though financial capital has flowed from other parts of the country through local banks, and many firms and corporations have issued bonds to employees and residents.

1.23 Nanhai county, Guangdong province, is highly industrialized but more urbanized than Wuxi. Its rural business sector is open to the outside world in foreign trade and business relationships (most notably, extensive processing arrangements with Hong Kong firms). Nanhai has a diversified structure of rural communities, with greater independence at the village and team levels. This has generated a variety of ownership patterns (community-owned firms are important but by no means dominant), as well as production-team enterprises, private concerns, subcontractors, joint ventures, and even cooperatives. There is a relatively open labor market, which has stimulated an influx of migrant workers from poorer areas outside the county. Capital flows from outside are less important because the county is well endowed with local bank savings deposits.

1.24 Jieshou county in Anhui province represents an average level of rural enterprise development; it is much less industrially developed than either Wuxi or Nanhai. Jieshou has a lively market in land, and a substantial number of large private firms have sprung up under the personal sponsorship of county government authorities. The county has encouraged these businesses to move to the county seat, where infrastructure and support services are available. Elsewhere, the level of industrialization remains low, and most community enterprises have gone out of business or have been privatized. Villages specializing in handicraft production have emerged as a new mode of rural non-agricultural development.

1.25 Shangrao county in Jiangxi province illustrates a level of rural industrialization significantly below the national average. Even though the county has mineral resources, rural income depends primarily on agriculture. Industrial firms are small and mostly unprofitable, despite an infusion of capital from the central government. The ownership and management of local enterprises follow the traditional community ownership mode, but this has not been successful. Firms must pay high tax levies to meet government expenditures. They are plagued by widespread overstaffing, poor management, and a lack of contact with markets.

1.26 Wenzhou prefecture in Zhejiang province is a poor and remote area that has achieved great success by permitting virtually free development of private-sector firms. It has a market in land, a thriving informal financial market based largely on private financial institutions, and extensive commer-
cial relationships with distant parts of the country. Wenzhou differs from Jieshou because the private sector is less dependent on the personal support of county and local government officials, and because there is more emphasis on the private development of services, especially finance. Wenzhou has a well-functioning labor market, and workers migrate to the booming towns from poorer, mountainous regions.

Conduct of Business and Market Interactions

1.27 Enterprises remain dependent on community governments and must obtain key factors of production through the good offices of local officials although on the margin, items such as steel and energy are obtained at market-determined prices. This is especially true of land and capital, but in some areas labor allocations also depend on official approval. Moreover, numerous permits and approvals are needed to start a business and stay in operation. Virtually all firms have roots in particular communities, obtain factor inputs there, and do not consider relocation an attractive option.

1.28 In the latter half of the eighties, the share of market-based transactions has increased. To a large extent, firms now do their own procurement and marketing. This takes place because China has a relatively thin commercial network in rural areas, and enterprises lack access to state distribution channels. As a result, firms employ relatively large purchasing and marketing staffs. Most sizable rural enterprises sell output outside the immediate locality.

1.29 Rural enterprises helped shape the markets for industrial goods that emerged in the late 1970s. A sharp rise in personal income generated demand that state enterprises were initially unprepared to meet. Opportunities to earn high profits attracted early entrants, mostly from richer areas that had already developed an industrial sector. As competition became more severe, prices and profit margins fell sharply, thus squeezing later entrants. Where new opportunities arose, they often required better skills and more advanced technology.

1.30 Market structure and the nature of competition vary across industries and products. For a few industrial goods, markets are essentially nationwide. In some industries the competitive advantages of smaller rural enterprises are so great that most state concerns have exited or are changing product lines. In still other industries transport costs or other restrictions may segment markets along local or provincial lines. Even so, there may be considerable competition within provinces and localities. Overall, the market generates strong pressures to perform well and is relatively unforgiving of mistakes; this contributes to efficiency, dynamism, and flexibility. Firms have no captive markets for their products and are also less constrained by price controls, making it unlikely that they will face chronic sellers' markets for their outputs. As a result, they have shown an impressive ability to adjust successfully to adverse circumstances through such various measures as product changes, wage cuts, new management, major restructuring, and priva-

Industrial Structure

1.31 The average rural concern is relatively small, and most rural communities are still largely nonindustrialized. In 1988, for example, the average township-owned industrial firm had 62 employees and gross output of Y 770,000; village enterprises were one-third as large. Many rural townships have only a handful of firms. The average size and number of firms per community are larger in more advanced areas like southern Jiangsu and Guangdong provinces, but almost none has annual output of over Y 100 million. This is because even the most developed rural communities have limited resources, and firms cannot freely acquire factors of production from elsewhere.

1.32 The more industrialized rural communities have a mixture of specialized and conglomerate structures. There is usually some specialization in a broad subsector or two (machine building in Wuxi, textiles in Xiqiao) but also a spread of firms across industries. Diversification helps communities handle the risks from market fluctuations in the absence of financial instruments for the purpose.

1.33 Industrial structure varies by regions. The more backward areas tend to develop basic food processing and resource-based industries like construction materials. Manufacturing and dynamic industries with the potential for rapid growth and labor absorption are concentrated in the more advanced coastal regions. Despite their increasingly higher wages, these areas still offer a better administrative and economic environment for development.

1.34 Rural industrial enterprises are more highly leveraged than other enterprises, partly as a result of rapid growth and the unavailability of government capital. Local government contributions provide seed capital (close to 30 percent of the total), but this share declines sharply as successful firms expand. The two most important sources of funds for established concerns are retained profits and bank loans, though arrears to other firms have grown in recent years (a reflection of tight credit). Capital from individuals accounts for a small part of the total.

1.35 Private concerns begin primarily with capital from founders, friends, relatives, and workers. If a firm is successful, it can finance expansion. But beyond a certain point, many larger private companies exhaust these two sources of capital and seek loans from rural credit cooperatives or the Agricultural Bank of China. Some may turn to the new nonbank financial intermediaries emerging in certain parts of the country.

1.36 There are inhibitions against exit by failing community-owned firms, though not as strong as in the state sector. The need to maintain employment is obviously important in localities with substantial surplus labor. In more developed areas where surplus labor may not be a problem, banks generally try to force community governments to take responsibility for bank debts. There is no incentive to shut down an enterprise unless it has a negative cash flow, since there is no provision for reducing debt by declaring bankruptcy. However, lower down on the ownership spectrum, exit is easier. In the face of severe financial problems, private businesses simply fold.

1.37 It is difficult to compare the efficiency of the rural enterprise sector and the state sector in terms of production costs and factor usage.
Finding comparable firms is a major exercise; ascertaining reasons behind observed differences is even harder, given economic distortions and a weak accounting system.5/

1.38 Many government firms must sell a large part of output through plan prices that make them appear less profitable. And the social expenditures of rural enterprises (worker welfare, pensions, housing) are lower, which allows them to record smaller costs and earn higher profits even without greater production efficiency. Rural enterprises use more labor and less capital per unit of output value. Any comparison that gives substantial weight to capital would indicate that this sector is more productive. But these kinds of estimates are biased by distortions on both the input and output sides, and in any case, there are variations across products and industries.

1.39 It would not be surprising to find the rural enterprise sector more efficient than the state sector in industries where it already accounts for a large share of total output. But sellers' markets and two-tier market pricing systems may allow high-cost small enterprises to survive in some industries like cement and steel.

1.40 Relative efficiency is perhaps not as important as market orientation, dynamism, and competitiveness. These three characteristics will move a sector in the direction of lower costs and greater efficiency. Thus, crucial issues concern the functioning of markets, the degree to which rural enterprises can respond to market opportunities, their adjustment to changing market conditions, and their overall competitiveness. In these respects, rural enterprises seem to have done better than state concerns, although they will need to evolve and develop to maintain their competitive edge.

E. Issues and Prospects

1.41 Restrictions limiting capital and labor mobility have not prevented rural enterprises from growing so far, but they may become a hindrance in the future. Rigidity of factors of production can be a problem as growth slows and the diffusion of relatively advanced technologies becomes an important determinant of performance. A major cause of factor immobility--and a potential problem in its own right--is the weak legal framework and sometimes discriminatory system governing rural enterprises. A great deal of new business and economic legislation has come into being, including a contract law, a bankruptcy law, and a state enterprise law. Yet enforcement and adjudication appear uneven, with apparent biases against outsiders in cases handled by local economic courts. There are also indications that some rural firms, particularly privately owned concerns, face discrimination. Though there has been some recent improvement, enforcement of laws and adjudication of cases are still problematic.

1.42 Rural firms have begun to encounter severe competition and market saturation in many industries. In 1989/90, for example, there were numerous

failures and financial problems. Some 3 million enterprises from the private and TVE sectors went out of business in 1989, about 25 percent of the total, though the number of firms which closed down permanently is still unclear. In some industries, the small size of many firms may hinder competition. Another weakness is the inadequate network of support services for rural industrialization. This mirrors the neglect of the Chinese service sector as a whole, but it can be a greater problem for small enterprises with meager resources. Scattered location patterns may cause static inefficiency and are likely to become an increasingly severe problem. When small factories dot the countryside, it is hard to set up a dense network of services; advantages of scale are largely lost, and transport costs are high. Moreover, wasteful land use is widespread: industries pollute high-yield agricultural land. Environmental difficulties mean high costs for pollution control.

Problems of Backward Areas

1.43 The degree of inequality in rural income, economic development, and industrialization is striking, and to some extent, worrisome. For example, average per capita income in Nanhai county is 3.6 times that in Jieshou county; industrial per capita output in Wuxi is an astonishing 95 times that in Shangrao, while agricultural output per capita is nearly 130 percent higher. Per capita wages paid by community enterprises in Wuxi are 28 times those in Jieshou. County statistics mask even greater differentials between rural communities. A highly developed industrial township in Wuxi recorded industrial output per capita close to 700 times the figure in a backward township in Shangrao. These differences in income levels and rural industrialization translate into huge gaps in local financial resources.

1.44 Unbalanced rural development patterns result mainly from the combination of highly uneven endowments of human and other resources and the immobility of population and factors of production. Backward areas also suffer from a lack of entrepreneurs, managers, and contacts with markets; predatory fiscal practices on the part of many county governments; and difficulties in gaining a toehold in China's increasingly crowded and competitive markets.

1.45 Fiscal predation occurs when community government revenues are insufficient to cover expenditures. In this situation (which generally arises in backward areas), government officials impose levies on their subordinate firms, whether or not those earn profits. Firms obtain the needed money by "eating" their capital stock (depreciation funds), borrowing from local banks, or both. This strains bank-government relationships and harms the financial viability and development prospects of enterprises.

1.46 Parts of Shangrao county have successfully implemented measures to deal with the problem of fiscal predation. These measures involve election of factory directors by workers, "contracts" between these directors and the community government, and a credible pledge by the latter not to levy more than a certain proportion of enterprise profits. Another part of this strategy is the mandatory retirement (sometimes with a "golden handshake") of incompetent government officials and enterprise managers. But these solutions may not work everywhere, and they have been most successful where inflows of funds have at least temporarily eased community resource constraints.
1.47 Nationwide policy changes could help reduce fiscal predation, but they would represent a sharp departure from past practices. The fiscal problems of backward townships can be viewed from two different perspectives: First, government is too big in relation to the resources of the community; second, too much of the financing burden for rural areas rests on grassroots rural community institutions regardless of their ability to pay. These problems require a two-pronged attack. Backward areas cannot afford and do not need the full government administrative structure and number of employees that may be necessary in more advanced areas where economic activity is much greater. And the state budget could partly or wholly absorb the public expenditure responsibilities of community governments. One way to limit the budgetary costs of this measure would be to permit the financing of expenditures only in localities with specified levels of poverty and backwardness.

Ownership and Institutional Structure

1.48 Evolving patterns of ownership are replacing traditional ownership by township and village governments. Many parts of the country have seen wholesale privatization of community enterprises. In the more backward areas, difficult conditions prevented the traditional system from becoming established, thus existing assets were often divided or sold off as part of economic reforms. New enterprises and sectoral growth have come largely from the private sector. In some parts of the country, such as southern Guangdong, a diverse ownership pattern includes numerous joint ventures.

1.49 If private concerns are to thrive, it will be vital to strengthen and clarify property rights. There is need for an evenhanded treatment of different forms of ownership by the legal and regulatory systems. And ownership rights in community enterprises that are undergoing various forms of privatization should be recognized and appropriately recompensed.

1.50 Fiscal incentives have played a major role in promoting the growth of the rural industrial sector. While these linkages will begin to weaken as part of the separation of the government's regulatory and fiscal apparatus, it is important to ensure that officials have adequate incentives to promote rural enterprise development. In this context, the uniform salaries paid to township officials may be counterproductive, given the great differences in average per capita income levels across regions and localities. In the most developed rural areas, for instance, a township leader's base pay is lower than that of an ordinary worker.

Capital Mobility

1.51 Immobility of capital leads to inefficient resource allocation, but more important it hinders growth and forces firms to remain smaller than is desirable. There is a great need to provide capital to investments that offer the highest return, but capital flows across provinces and regions are difficult because of the continuing immobility of other factors. For example, large outflows of funds from poorer areas to more developed localities would exacerbate the problems of the backward regions.

1.52 In addition to encouraging greater capital flows within the rural banking system, a possible way to enhance local capital mobility and improve the efficiency of investment would be through new rural financial institu-
tions. These could provide services to small enterprises and generate competition with the existing state-owned banking system. To realize the benefits from greater institutional diversity, many of the new institutions should cut across local and community boundaries; up to now, most of them have been community-based. Some financial institutions could be structured as joint ventures among different governments. Cross-community joint ventures among enterprises within the sector are another way to concentrate scattered rural capital and direct it to high-return uses.

Support Services

1.53 The network of support services for rural enterprises is for the most part inadequate. While this is true throughout the economy, the problems of small firms are exacerbated by the lack of access to services provided by state institutions, and their inability to handle such services themselves. This is beginning to change as the state-owned firms become more profit-oriented. Not that large government programs to provide support services should be established. Enterprises should pay the full cost of any services they obtain from government institutions, and these agencies should not take advantage of their monopoly position or administrative power to gouge users. A shift toward developing industrial support services within the rural enterprise sector, on a profit-oriented, commercially viable basis, would play an influential role in stimulating growth. Many services are most efficiently provided by small firms, so they represent a great opportunity for this sector.

1.54 Some measures that might encourage the rapid development of services are greater freedom for professionals and skilled workers to leave their firms and set up service businesses; greater concentration of rural industry, which would also concentrate demand for services; and improvement of the legal and regulatory environment for private owners, since the relative importance of services is greater for this group.

Prospects for the Future

1.55 From all indications rural enterprises will continue to grow in importance. While they do not require massive government support, new agencies, costly programs, or administrative regulation, the role of government is crucial in some respects. More important than any positive measures to support rural enterprises (though some may be called for) is the need to avoid policies and restrictions that damage rural firms, based on the mistaken notion that they are sources of problems elsewhere in the economy. Similarly, rural enterprises should not be held back because competition is making life harder for many state-owned firms. With a move toward a level playing field, enterprises of all types can compete on an equal basis, with fewer restrictions rather than tighter regulations. Rural industry is not the main source of macroeconomic instability and should not be disproportionately affected by tight credit or other restrictive policies designed to deal with overheating of the economy. The long-term prospects for the rural enterprise sector are bright as long as it is allowed to develop, evolve, and adapt to China's changing economic and institutional structure.
II. ZHEJIANG: CHALLENGES OF RAPID URBANIZATION

Introduction

2.1 China's urban sector has experienced rapid growth since 1979. At the end of 1988, China's urban permanent resident population totaled 544 million which is about half of the total population. Urban growth since 1979 has averaged 13 percent per year. Expansion of light industry and services and reduction in the demand for labor in agriculture has contributed to the accelerated urbanization resulting in a huge increase in the demand for urban public services and associated infrastructure. But the investment in these sectors has not kept up with growth of urban population. The percentage share of total investment in the transport sector has fallen from 15 percent in the 1970s to 14 percent in the 1980s and in urban public services, it has increased from 3 percent to 6 percent only. The growth rate of investment in transport and urban public services in the 1980s was barely equal to the growth of urbanization (13 percent).

2.2 Strict controls on city size slowed urbanization in China. Between 1958 and the mid-1980s, the government contained the influx of migrants to the cities through the household residency registration system—a policy enforced by associated restrictions on access to food ration cards, employment, and housing. There was little investment in urban infrastructure, which was considered a nonproductive activity rather than an input in the efficient production of goods and services. The cities and towns took on a neglected appearance, with deficiencies in housing, transportation, water supply, and disposal capacity.

2.3 In 1960s and early 1970s, economic growth was too slow to test China's policies to control city size. Since 1978, however, major shifts in macroeconomic policies have restored household farming and reformed the urban economy, bringing market forces into play. As a result, two trends have emerged that have promoted urbanization: improvement in agricultural efficiency has generated surplus labor, and urban light industry and services have developed a huge appetite for workers.

2.4 Policies to control city size have had to bend under these circumstances. Beginning in the mid-1980s, temporary access to cities and towns became increasingly available to rural residents; in return, the government withdrew any commitment to provide the new residents with food rations, jobs, or housing. In any case, economic reforms effectively undercut the former constraints. The resurgence of agriculture and the expansion of private mar-

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1/ China Statistical Yearbook 1989, page 63: Urban population refers to the population in areas under administration of city and towns. Rural population including all those living in counties but excludes people who live in towns within county boundaries. The sharp increase in urban population since 1984 is due to the increase in the number of newly established towns.
kets made food rations unnecessary. Jobs became available outside state/collective enterprises. New housing solutions—from subleasing to dormitory living are emerging but policies and regulations limiting city size have remained on the books.

2.5 The anticipated pace of urbanization raises major challenges, including issues concerning temporary residents and city size. The national government will have to direct massive investments to meet demand for urban infrastructure and services. Attention will need to focus on financing mechanisms and intergovernmental fiscal relationships. Urban planners will have to develop land-use policies for industrial, commercial, and residential purposes.

2.6 To understand the key issues involved in urbanization, this chapter looks at the rapidly developing coastal province of Zhejiang and considers four broad urban problems: housing, water and waste, transportation, and municipal finance. Although the study looks at the overall urbanization of Zhejiang, the conclusions are based on data from five cities and six towns.

A. Background

2.7 Located on the coast, Zhejiang is directly south of Shanghai and Jiangsu province. To the west are Anhui and Jiangxi provinces; to the south, Fujian. Blessed with a temperate climate, Zhejiang has a strong agricultural and industrial base, ranking seventh among China's provinces and provincial-level municipalities. Between 1984 and 1987, agricultural output increased at an average rate of 8.7 percent a year in constant prices, while industrial production increased at an average rate of 21.7 percent a year. Clearly, agricultural reforms and economic liberalization have been highly successful in Zhejiang.

2.8 Urban growth has soared, especially in smaller cities and towns, since workers have been allowed to migrate if they can find housing and assume responsibility for their own food requirements. In 1985, 15.3 million of Zhejiang's 40.3 million people were urban residents, up 55 percent from the 9.9 million urbanites recorded in 1981. Official data refer to those with permanent urban household registration and exclude the growing number of migrants allowed to register as temporary residents. This report includes these individuals in the population totals, since little evidence exists that they are temporary residents in anything but name. The estimates used here also control for boundary changes and for the enormous increase in the urban population caused by the inclusion of newly incorporated towns; the recon-

2/ Rationed grain to registered, permanent urban residents is subsidized, as is housing provided by state enterprises. Temporary migrants with equivalent income levels who do not benefit from such subsidies must accept a lower standard of living.

3/ Hangzhou, Ningbo, Wenzhou, Shaoxing, Quzhou cities; Keqiao, Xikou, Beibaxiang, Huzhen, Jianqiaou, and Tangxia towns. The information was gathered in 1986 but it has been updated wherever possible.
structed statistics refer as closely as possible to the same centers and the same boundaries as existed in 1985.

2.9 From 1980 to 1985, cities grew at an average annual rate of 2.8 percent, while town population rose 3.9 percent per year. This information does not, however, highlight the demographic statistics of most interest to those planning urban infrastructure and urban service investments. For them, the critical variable is the population of the high-density core in urban areas within which a full range of public services is provided. Such built-up areas cover between 5 and 15 percent of the cities and towns, but contain, on average, 60 percent of the people. The remaining population is largely agricultural and is counted as urban only because of the way city boundaries are drawn. Overall, the population of the core expanded at an annual rate of 6 percent—a rate that, if sustained over 15 years, would swell the urban population 2.5 times by the year 2000.

Urbanization Policy

2.10 After 1949, the provision of jobs for urban residents became the government's responsibility. This policy was all the more onerous to the state because jobs carried lifetime employment benefits and implied substantial welfare and pension commitments. Furthermore, the government extended to nationalized and public-sector employees benefits originally provided only to government cadres, including access to subsidized public housing, food, and other rationed commodities.

2.11 Since 1958, the government has discouraged the growth of larger centers and encouraged the expansion of townships, towns, and small cities. Despite this policy, urban centers of all sizes have expanded. The massive influx of so-called temporary residents is transforming the urban economy. These migrants dominate the growing construction and service sectors and also play a role in industry. Working for low wages, they often hold jobs that permanent residents are unwilling or unable to do. Zhejiang's cities reflect the strains of this large urban migration. Traffic congestion is now a major complication. The rapid increase in new multistory housing and the accompanying rise in demand for water connections and flush toilets has strained the water systems. Pollution, especially of urban waterways, is serious.

2.12 These problems do not argue for administrative controls on city size, since they can be effectively handled even in large cities. A solution is rather for local governments to invest in new facilities while adopting planning and management policies that ensure efficient physical development. The situation is complex because officials must cope with a system of urban management characterized by inadequate investment levels and poor cost recovery. If central or provincial government allowed cities to assume more responsibility for financing the capital and operating costs of facilities, it

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4 This policy has had different city-size thresholds over time. At present, small urban centers are defined as having under 200,000 "permanent" residents (those with permanent urban household registration). These receive subsidized grain and are often beneficiaries of state-allocated jobs and housing. Visitors and other residents in cities for a period of more than three days are required to register as "temporary" residents.
would no longer short-circuit the mechanism by which increased costs of living and doing business in an urban center pass to residents and enterprises. Many towns in Zhejiang have begun to impose appropriate user charges. Though they have received no official permission to do so, these communities have created local sales surcharges on business activity and "betterment fees" (taxes) on investment by businesses and households. In this way, localities can handle the investment and service requirements associated with rapid growth.

2.13 Policy changes can modify the price signals that currently exaggerate the attractions of large cities. In market economies, there are built-in price mechanisms that affect the lure of large urban centers and discourage less productive activities, land-intensive businesses, and heavily polluting enterprises. As a general rule the cost of living, and therefore of many economic activities, rises sharply with city size, forcing wages up to pay for higher costs of land, food, utilities, and services. Businesses face higher costs for labor, land, utilities, transportation, and taxes. In addition, environmental controls become stricter with increasing city size, forcing polluting enterprises in large centers into more and more expensive solutions. These forces encourage the relocation of certain investments. And potential new investors considering large cities as a base are likely to judge critically the potential benefits of such locations.

2.14 The Chinese government is already implementing or considering reforms that will force investors and enterprises to face the true costs of doing business in an urban center by raising land fees and public-service charges and lowering subsidies. If cities can mobilize the resources to tackle a backlog of priority investments, infrastructure and services can be supplied efficiently while forcing the beneficiaries to pay, directly or indirectly. An increased reliance on market signals, better management, and more local autonomy in planning and financing services will greatly reduce the need for direct administrative controls on city size. In any case, the very logic of the modernization drives makes it increasingly possible for new migrants to get work, food, and lodging without going through government channels. Yet controls over these have been the government's policy instruments. In the coming years, it will be difficult to control urban population growth brought on by migration. It is therefore time to plan to accommodate that growth.

2.15 Urban Planning. China's current urban planning system is not well-equipped to deal effectively with the problems of rapid urbanization. Urban development policies focus on the enforcement of rigid, centrally established land-use regulations and supply-driven norms that fail to take into account local demand and affordability considerations. The value of land has not yet been factored into planning. Little effort is made to vary norms and standards to reflect the trade-offs that potential users will accept when they face charges high enough to pay for needed housing, infrastructure, and services. There is no development and analysis of fully-costed alternatives and no effort to vary solutions according to location and user demand. Physical planning is handled independently of the calculation of capital, operating, and maintenance costs. Planners dealing with residential development and land-use issues do not appear to coordinate with agencies in charge of other infrastructure development. Projects are designed as discrete entities without considering their cumulative impact on long-term development. Urban design practice has also introduced certain distortions that have prevented
mixed-use developments in accord with user preferences. The separation of sites for residential use, services, and nonpolluting industries is often excessive and raises regional transportation costs.

2.16 The overall effect of these approaches is the inefficient use of land and physical facilities. Urban developments are being designed to satisfy national density norms that do not reflect realistic land values. As a result, design densities are far below existing urban densities. Physical planning can be somewhat divorced from financial constraints so that local authorities often plan facilities that are unaffordable to the ultimate beneficiary. Supplies of facilities and services are often stalled as planners await funding for extravagant projects instead of scaling down their requirements. Furthermore, authorities seem at times unaware of possible low-cost improvements that would rehabilitate existing housing and other urban infrastructure.

2.17 Housing. Enormous progress has been made since 1980. Housing stock in Zhejiang has increased in the eighties by more than 50 percent and living space per person by 42 percent. Still, a large number of households cannot afford new housing at current costs. They have insufficient savings and no access to financing mechanisms, and they do not work for enterprises that can afford to buy units and rent to employees.

2.18 One solution to the housing shortage is to increase residential densities in new developments, thus saving land and infrastructure costs and making housing more affordable. Even then, rents will have to be increased; present charges cover only a fraction of maintenance costs and none of the other costs. This means raising wages by perhaps 25 percent, because urban workers view rent subsidies as part of total compensation. Reforms that allow rents to approach market-clearing levels will also stimulate investment in private or cooperative housing by encouraging households to consider homeownership. The availability of mortgage financing will be critical.

2.19 Towns in Zhejiang are already meeting many of the challenges faced by city developers. (This has been possible because towns are less closely supervised than cities.) A large percentage of new housing is privately built to high but affordable standards. Infrastructure is often user-financed, and land-use standards are elastic enough to take land values into account. As a result, centers have developed at relatively high densities. Space is used for housing, commerce, services, or small industry, depending on the occupant. As towns grow, they integrate marginal infrastructure additions with existing facilities.

2.20 Water Supply. Although Zhejiang has ample rainfall well distributed throughout the province, the per capita amount of water available is only 85 percent of the national average. Unregulated streams supply most urban water; no city has a reservoir as its principal source. All cities and major towns provide water supplies, and 90 percent of residents have access to piped water. Industry consumes about 52 percent of municipal supplies and also provide an amount equivalent to what it draws. Piped water demand, however, exceeds normal capacity by a considerable margin.

2.21 The basic problems are the lack of past investment in facilities to extract, treat, and distribute water and pricing policies that have not pro-
duced water conservation and cost recovery. The water rate is uniform. Since prices have not been raised in the recent past, consumers--particularly industries--waste water.

2.22 The authorities recognize the need for major expansion to meet present needs and planned growth. All the municipalities studied have prepared proposals for major schemes to augment water supply facilities for the next 15 years. In most cases these plans are appropriate in terms of technical and social considerations, but they cover only intake, transmission, and treatment costs and largely omit distribution and reticulation costs. Substantial additional investments will be required to upgrade and extend the reticulation system, thus these estimates hardly reflect true costs. If cities can impose user charges and establish more appropriate pricing policies, there may well be a reduction in demand.

2.23 Waste Water and Pollution. While China has a long history of municipal water supply, collection and disposal of waste water is relatively new. In all cities, human waste has been collected by a night-soil system and sent to agricultural areas for use as fertilizer. One result of improved urban conditions is the much wider use of flush toilets. Cities plan to phase out the night-soil system by the year 2000. This may prove infeasible, however, since most cities may have no options other than waterborne disposal to replace the night-soil system. Sewerage with full treatment may be the eventual solution, but interim solutions such as conservancy tanks are also needed.

2.24 In Zhejiang, there are no domestic waste-water treatment plants, although 39 percent of industrial waste water is treated. The major rivers are not yet significantly polluted, but there are localized problems. In the past, waste water and storm water were channeled together to the nearest waterway. The increasing pace of urbanization and industrial growth has led to a dramatic deterioration of the urban waterways. Pollution is on the increase.

2.25 The province has yet to develop a strategy to manage industrial waste-water disposal. The present approach is to require industries to improve the standard of the waste products they discharge. Laws and administrative mechanisms to implement this policy are on the books, but they are not applied consistently. There is justifiable doubt as to whether this approach, which requires construction of expensive on-site treatment plants, is better than building a central sewerage system for both industrial and domestic disposal. If sewerage is the adopted solution, it may still be possible to delay heavy capital investments by providing incentives to get industries to reduce their pollution loads through better housekeeping and resource recycling.

2.26 Urban Transportation. A dramatic increase in bicycles, cars, and buses has worsened the traffic situation in most cities. Freight and passenger demands are up and vehicle ownership is rising because of greater economic activity and mobility. Yet there has been no corresponding increase in the supply and efficiency of transport infrastructure and services. Traffic congestion, long delays, and a growing number of accidents constrain economic development.
2.27 The speed of public transport has declined markedly; during peak hours, buses sometimes travel no faster than bicycles. This means that more buses are needed to carry the same number of passengers as before. Because fares are low, buses are poorly maintained and seldom replaced. There is a urgent need to combine traffic management measures that give buses priority with a judicious program of road widening and new construction.

2.28 A serious obstacle in dealing with traffic is that most of Zhejiang's cities were formerly walled and had narrow roads—and these have been neglected for the past three decades. Road-widening will require the demolition of a large number of houses, a costly undertaking that would, in addition, temporarily reduce the supply of housing. Urban planners, in siting residential and industrial projects, have only contributed to the problem by creating long commuting distances. Physical improvements thus require complementary institutional changes.

**Municipal Finance**

2.29 Zhejiang's urban public finance operates under a division of responsibility. The central government is responsible for tax policy and determines the rate and base of each tax. The provincial government determines how revenues will be shared among local governments. The municipal government is responsible, with a minimum of supervision, for assessing and collecting virtually all taxes. Taxes collected at the lowest level are "shared up" with the province, which then "shares up" with the center. Zhejiang turns over 45 percent of all revenues collected.

2.30 The central government limits local government fiscal autonomy, but some important doors remain open. Local authorities cannot set tax rates or define legal tax bases; they are prohibited from borrowing and are limited in their ability to determine the level and composition of expenditures. But they can negotiate tax liabilities with enterprises under their jurisdiction. They can adjust output targets, adopt a vigorous or weak policy of tax enforcement, adjust sharing arrangements with subdistricts, and spend extrabudgetary funds without much central direction. And the most enterprising among them may introduce new approaches to financing urban services.

2.31 Municipal governments receive revenues from three major sources: taxes on profits, sales taxes, and user charges. The profits tax consists of a basic 55 percent rate (or a graduated schedule for smaller firms) and an excess profits tax (known as the "adjustment tax" which is gradually being phased out) ranging up to 30 percent. This tax is meant to redress inequities arising from the switch from a remittance to a tax system in 1983. It applies to enterprises whose products sell at relatively high fixed prices as well as those that have benefited heavily from past government investment. These firms could earn "excess" profits, which the government attempts to tax away according to a complicated formula.

2.32 A third component of the profits tax is a 15 percent central government levy applied against retained earnings and earmarked for energy and transportation projects. The municipal government assesses and collects the contribution but retains very little of the revenue. There is also a 10 percent tax on certain capital construction investments financed from retained earnings, and a graduated tax rate applied to "excess" wage bonuses paid from
retained earnings. The province and the municipality share revenues from the profits tax and the adjustment tax; the city's share amounts to roughly what it received under the previous remittance system in 1983 plus 70 percent of any increase above that amount. The municipality keeps about half of the wage bonus tax, but the capital construction tax goes to the province and the retained earnings tax to the central government. It should be noted that these general sharing rules do not hold for every local government in the province. A municipality or a county could be allowed to keep all the profits tax collected. This points up an important feature of Chinese intergovernmental fiscal relations: the provincial government can freely alter the sharing formula. The percentages vary among local governments depending on their level of economic development and on the extent to which their economic basis is dominated by large, centrally owned enterprises. It is not clear that tax policies that include such a large element of discretion are sustainable in the long run.

2.33 China's most productive tax is its uniform national sales tax. The tax has three components: a gross receipts tax levied on a wide range of products at rates ranging from 3 to 70 percent; a value-added tax on selected sectors (from 6 to 25 percent); and a sales tax on services (3 to 5 percent). Municipal governments receive little of this revenue; 90 to 95 percent of the increase over the previous year goes to the province, as does an amount equivalent to the previous year's level. (The provincial government can and does alter the sharing percentages to favor some local governments.) A tax equivalent to 7 percent (5 percent for towns) of total sales tax liability, known as the "Urban Maintenance and Construction Tax," accrues entirely to the municipality. This tax is a chief source of municipalities' funds for urban construction and maintenance.

2.34 The current reform drive will bring new fiscal opportunities and problems to local governments. These changes could be especially important in four areas. First, with more enterprise autonomy local governments will shift their emphasis to infrastructure development. Second, as local authorities lose control of the tax bases of enterprises, they will need to administer taxes more efficiently. Third, local governments may find themselves competing for new industries, possibly on the basis of the level of public services they offer and their effective tax rates. Finally, local governments may look to the retained earnings of enterprises as a new source of capital financing for infrastructure, and this may lead to more use of benefit charges and borrowing.

2.35 How well equipped are local governments to handle this new role and to take advantage of these opportunities? What hurdles must they overcome in order to support the reforms? Officials face several problem areas: a revenue base that is not growing adequately, a system of implicit prices that compromises some of the objectives of a "good" fiscal system, weaknesses in tax administration, and inadequate fiscal accounting and planning. The system gives municipal governments no authority to levy taxes independently, change user rates, or borrow funds. It seems clear that the central government must decide if urban governments will have more autonomy to mobilize funds to invest in infrastructure and public services. Several reforms might be considered. Local governments could have greater latitude to adjust user charges and tax rates or to impose specific local levies. One possible approach would be a land-use charge. An alternative would be to raise the share of revenues
divided with the province, perhaps applying the new rate to the combined total of all shared taxes. This would remove some of the disincentive for assessing and collecting some taxes more vigorously than others.

2.36 Still another way to mobilize resources is to develop a mechanism for local government borrowing and benefit financing so that cities and towns could finance capital projects by stretching out repayment over a number of years. Simultaneously, consideration should be given to making remaining capital grants available on a more predictable basis.

2.37 Improved resource mobilization is an important element in the process of improving city facilities and provinces. In addition, urban governments should take measures to improve the effectiveness of local financial planning. Municipal governments should produce regular consolidated budgets identifying all capital construction and recurrent expenditures and funds and tracing out all interaccount transfers. Multiyear budget forecasting and capital budgeting should also be introduced.

2.38 Under the new tax system liabilities are calculated by the taxpayer. The system requires extensive auditing, which is laboriously computed by hand. Local governments are not geared to collect taxes from a rapidly changing clientele. As the balance of economic activity shifts toward the harder-to-tax collectives and private businesses, a significant amount of taxes could go uncollected. And, since local governments now legally own most medium-sized and large enterprises, the incentive to collect taxes is in conflict with the desire to ensure enterprise profitability. This is all the more serious an issue because tax assessments allow for a fair degree of discretion and negotiation, especially where taxes on profits are concerned.

2.39 While higher-level authorities complain about the revenues available to them, local governments face mounting investment requirements that must somehow be financed if major bottlenecks are to be resolved. New local government revenue options should be explored, including higher user charges, financing schemes funded by directly affected property owners, local taxes or surcharges, and land fees. With these measures in place the urban sector should be able to meet development needs without recourse to funds from the rural sector or from new central or provincial-level grants.

B. Conclusions

2.40 The rapid growth of Zhejiang's economy is mirrored in the increase in the urban population of cities and towns. Much of this expansion has been fed by the migration of rural workers, whose temporary status is belied by the facts. The time has come to put policies in place to accommodate rapid urban growth, regardless of its source or location. Past neglect has created a significant backlog of potential investments with high rates of return in water supply, sanitation, roads, and public transportation. Rapid future growth will create even greater demand. The concurrent increase in serviced land development can only be managed efficiently if efforts are made to economize on land use and physical facilities through a careful review of norms and standards. Housing programs are delivering large increases in additional floor space each year, but officials need to consider rehabilitating rather than demolishing older housing stocks as part of a larger effort to develop housing that consumers can afford. Consideration should be given to making
explicit the cash value of rent subsidies, raising rents to market levels while simultaneously adjusting wages, and introducing mortgage instruments for private purchasers.

2.41 Urban investment cannot be financed with appeals for increased central and provincial grants. In a country where the rural sector is self-reliant, even though relatively poor, the urban sector must self-finance most of its future growth. For this to be possible, new local sources of revenue must be made available. The creation of a municipal lending authority also merits attention; borrowing facilities would allow local governments to finance long-lived investments by mobilizing repayment resources from both present and future beneficiaries. To ensure that this money is spent wisely, local governments should engage in multiyear budget planning, within which physical plans and financing are carefully aligned. With these measures in place, the urban sector would be able to meet the development challenge of the 1990s.
III. THE ROLE OF TECHNICAL AND VOCATIONAL EDUCATION

3.1 Rapid growth and economic reform in China have turned the government's attention to inadequacies in the training of the work force. In the drive to develop industry and agriculture, policymakers are grappling with attempts to improve the educational level of the labor force through an expanded technical and vocational education program. This goal has highlighted a parallel problem: The measures governing employment in state enterprises tend to neutralize many of the benefits of extensive training. But changes are underway.

3.2 The government has proposed reforms in labor-market hiring practices focusing on standards for employment and requiring training to reach these standards. These are designed to spur formal and informal training modes, as are regulations to gradually dispense with the policy of lifetime employment. The proposed reforms were announced in the Education Reform Act of 1985. The measures covered all areas of education, but vocational training, perceived as the weakest link in the chain, attracted special attention, including:

(a) A policy aimed at enrolling 50 percent of all entrants to upper secondary schools in vocational programs by 1990 (the so-called 50-50 rule).

(b) Strengthening training to meet labor market needs.

(c) Providing general education courses along with technical training programs.

(d) Working with enterprises in developing appropriate curricula.

(e) Correcting the serious shortage of specialized vocational education teachers.

3.3 These proposals place enormous demands on the upper secondary schools, which are already constrained by lack of resources. They will not make the system more responsive to the demands of the economy but focus on expanding it, even though the operation and management of secondary schools is considered less than optimal. The proposed expansion, moreover, seems beyond the financial resources potentially available.

3.4 Rather than forging ahead with a large-scale expansion, it would be advisable to improve the quality and efficiency of the existing technical and vocational education programs. Equal emphasis must be given to upgrading existing workers through in-service training and postsecondary school technical training. Reforms to improve labor mobility and provide greater wage differentials are a necessary condition as well.

A. The Economic Context

The Labor Market

3.5 Several characteristics of the Chinese labor market are noteworthy. These include: the educational level of the labor force; the practice of
lifetime employment; restricted labor mobility; central job assignments; narrow wage differentials; and high youth unemployment. The present system is being modified, however, to encourage growth and efficiency. Recent labor market reforms are designed to inject competition into the job market and motivate workers to acquire skills to qualify for better jobs and higher wages.

3.6 The regulations define procedures for recruiting, allow employers to dismiss workers and require that workers be trained before employment. The reforms aim at ending the practice of inheriting jobs—a practice that has often prevented employers from hiring the best trained and most motivated workers. Further, the regulations limit the enterprise to recruiting from the ranks of lower secondary school graduates. The most revolutionary change is the labor contract system, which is designed to eliminate guaranteed lifetime employment, a practice that has historically reduced motivation and led to overstaffing.

3.7 Educational Structure of the Labor Force. By 1985 China had a adult literacy rate of 69 percent, close to the level of the middle-income countries. The policy of restricting higher education has allowed China to achieve almost universal access to primary education with an expenditure on education of about 3 percent of gross national product, compared with 4 percent for the average developing country. Secondary enrollment ratios are above average for low-income countries but substantially below middle-income countries (37 percent versus 54 percent in 1987). Enrollment in higher education is far below that of the average middle-income country (5 percent versus 12 percent), but recent expansions have raised enrollment somewhat.

3.8 Despite these achievements, the educational level of the labor force remains a problem. The Cultural Revolution (1966-76) had severe consequences for the labor force. Secondary schools were closed, the technical and vocational education system was dismantled, and colleges and universities were shut down. The 1982 census showed that the proportion of the male population with a postsecondary education was twice as high in the over-35 group as in the group aged 25 to 34. These deficiencies have been partly addressed through large-scale adult education programs within the work place and outside. These programs are discussed in more detail in the chapter on higher education.

3.9 The shortages in technical professions are serious. Data from 1989 indicate that the ratio of engineers to technicians in China was 1.4 to 1, or 4.807 million engineers versus 3.453 million technicians.1/ (Planning authorities consider a ratio of 1 to 3 appropriate.)2/ A survey of the needs for higher-level manpower between 1983-2000 projects a need for about 9 million university graduates, 8 million polytechnic graduates, and 17 million specialized secondary school graduates. There have been no projections of how

many skilled workers or other types of graduates are needed. Of the 128 million urban workers, 40 million are classified as skilled, but over 70 percent are in the lowest skill categories. Although the shortage is partly the legacy of the Cultural Revolution, the lack of well-planned, systematic on-the-job training, and the reward system, which workers to acquire new skills are also to blame.

3.10 The Iron Rice Bowl. In the past workers in state enterprises were employed for life after an initial one-year probation period. They could not be fired or moved without permission—a difficult process that was rarely attempted. Furthermore, state enterprises are generally not allowed to fail, either because of poor management or adverse market movements, thereby guaranteeing workers a wage regardless of the enterprise's performance. This was the "iron rice bowl" that recent reforms in labor regulations and enterprise management are attempting to break. How far these changes will go is highly uncertain in the face of resistance by workers who view job tenure as a right (and even as their child's right). Voluntary mobility between jobs is also reduced by the housing, pension, health, and welfare benefits that accompany a job and do not move with an individual. Members of collectives and self-employed workers have no such guarantees, but they do effectively have much more job mobility within the same area.

3.11 The core work force in state and many collective enterprises enjoys the guarantee of lifetime employment. This has significant implications for investment in education and training. Prior to the enterprise reforms, under which there is some accountability for profits and losses, firms were anxious to get better-trained manpower to meet production targets but insensitive to the costs since all revenues were retained by the state and all approved expenditures were covered. Under the new system, firms are inclined to weigh the costs and benefits. Lifetime employment allows firms to capture benefits. Under the labor contracting system that has been spreading gradually since 1986, enterprises might be less willing to train workers. Or businesses may decide to invest in training that yields a high rate of return over the contract period. One option would be to negotiate longer contracts for employees that have been trained.3/ At the same time there might be stronger motivation on the part of workers to obtain training because of the policy to train before employment—and perhaps greater rewards to training due to job mobility and higher wage differentials. Undoubtedly the net effects will differ greatly depending on the circumstances of local labor markets.

3.12 Labor Mobility. Because requirements for residence permits and grain rations restricted labor mobility, China's urban population has until recently grown more slowly than is customary in other developing countries. Although grain rations are now of little significance, residence permits still limit geographical mobility. As a consequence, labor skills for the most part must be met by the local school system. Often a surplus of certain skills found in some areas while shortages exist elsewhere. This situation has meant that local areas have an incentive to train individuals because they are forced to work locally. But the municipality itself may not be responsible for the training, and smaller areas, such as districts, may not want to train

3/ Contracts are for three to five years and experience to date (1990) suggests that few workers are discharged once the contract period is over.
since their trainees can work elsewhere in the municipality. As mobility increases, the municipal or state government, or the individual worker, will have to assume the responsibility for specialized training.

3.13 Labor mobility has also been constrained by the practice of job assignment, although the orbit of this system is being narrowed. Until 1980 graduates of upper secondary schools who did not enter college were assigned to specific jobs. Today, only graduates of higher educational institutions (except polytechnics), secondary technical schools and skilled workers' schools are guaranteed jobs. Since over 90 percent of the students graduate, admission to these programs is tantamount to employment. Beside reducing the student's motivation to study, this practice also leads to a high demand for places in these institutions.

3.14 The system, though, has had two effects on enterprise support for vocational training schools. On the one hand, the difficulties of getting the types of workers and technicians needed has encouraged employers to establish training schools to meet their needs. On the other hand, because all those admitted were guaranteed a job upon graduation, there was a reluctance to expand enrollment since new positions to absorb them might not be available. Thus these schools have remained small.

3.15 One motivation for expanding technical vocational education is to provide more trained manpower for the nonallocated portion of the labor force. Government officials are anxious to reduce the job guarantee process. The recently developed polytechnics, discussed in another chapter, have not been placed in the assignment system, and there are also experiments that allow students in some key universities in Beijing to find their own jobs. For those outside the central assignment system, job placement is handled at the local level through labor bureaus or labor service companies, but there is also more open recruitment for positions or quotas that were unassigned. It is unclear how the preemployment training policy will affect guaranteed assignment. Traditionally state employees have been recruited from new entrants to the labor market. There first few years are spent in training. While the new labor regulations recommend that only trained individuals be hired, the policy does not define what type of training qualifies or what happens when training opportunities are not available. Nor does it define how the preference for those with training will be carried out. Theoretically, this policy should increase workers' demands for training, but it is possible that it may reduce the employers' perceived responsibility for training.

3.16 Wages. There are relatively small wage differentials across skill categories in China and few incentives for individual effort. The average annual wage of staff and workers in industry was only 35 percent higher than that of agriculture. Substantial bonuses are paid over and above wages, but these are generally applied across the board in an enterprise. Thus when an enterprise is thriving, all workers benefit whether or not they have contributed toward its success. This would encourage moving to thriving enterprises if workers were permitted to move, assuming that state enterprises could hire more employees. Although the small wage differentials tend to discourage workers from upgrading their skills through in-service training or other educational programs, in fact the demand for continuing education exceeds the supply. In part this is because part-time training does not entail a loss of pay or bonuses. Full-time training may result in a loss of bonuses, but work-
ers receive their regular wages. The demand for training may also reflect the fact that since it is impossible to earn more by changing jobs or taking second jobs, there are few alternatives to upgrading.\footnote{Some continuing education is also reported to be for recreational purposes. This might be particularly important given the lack of leisure opportunities.} From the employer's perspective, the narrow wage differentials mean that there is little incentive to economize on highly skilled labor; on the contrary, it pays to ask for a higher skill mix than is required.

3.17 Youth Unemployment. In 1982, 77 percent of the unemployed were under 20 years old, about 12 percent of the 15- to 19-year olds. The actual unemployment rate would be much higher, however, since over eight million youths were enrolled in upper secondary school (mostly in urban areas) and thus were not considered part of the labor force. This would imply a youth unemployment rate substantially above Japan's 6 percent in 1982, and perhaps quite close to Britain's 17 percent in 1981. However, youth unemployment will decline as the number of new labor force entrants diminishes from the late 1980s to the end of the century. As labor markets tighten, employers will compete harder for employees and will have to rely on retraining present workers.

Technical/Vocational Education at the Secondary Level

3.18 China expects to achieve universal education through the ninth grade towards the end of the 1990s and aims to expand higher education to provide specialized personnel for modernization. It is more difficult to determine appropriate goals for the intermediate level of education since secondary education has the dual goals of preparing students for higher education as well as training for direct employment.

3.19 Enrollment in upper secondary education (grades 10 to 12) is about 20 percent of the age group. Sixty percent of these students are enrolled in college preparatory courses. Schools differ greatly depending on their resources and their pass rates on examinations for admission to colleges and universities. There are resource-rich key schools and ordinary upper secondary schools. There are, in fact, national, provincial, municipal, and even county key schools, and the resources devoted to each differ substantially. The key schools represent an attempt to achieve excellence in an environment of scarcity.

3.20 The alternative objective of preparation for employment is pursued by three types of upper secondary schools: first, the secondary specialized schools (including teacher training schools, which are discussed in another chapter, and secondary technical schools); second, the skilled workers' schools, and third, the agricultural/vocational schools. Basic information on these schools is summarized in Table 3.1. This system originally offered different specializations but the three schools now overlap in their training.
<table>
<thead>
<tr>
<th></th>
<th>Secondary technical schools (STS)</th>
<th>Skilled workers' schools (SWS)</th>
<th>Secondary technical/vocational schools (SVS)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Expected employment</strong></td>
<td>Mid-level technician (cadre)</td>
<td>Mid-level skilled workers</td>
<td>Technicians and skilled workers</td>
</tr>
<tr>
<td><strong>Placement</strong></td>
<td>State responsible for job assignment</td>
<td>State responsible for</td>
<td>No formal job training</td>
</tr>
<tr>
<td></td>
<td></td>
<td>job assignment</td>
<td></td>
</tr>
<tr>
<td><strong>Entrance requirements</strong></td>
<td>Lower secondary education. Entrance examination for some schools. Others require completion of upper secondary graduates.</td>
<td>Generally lower secondary school</td>
<td>Most require completed lower secondary school. Some in rural areas take primary graduates.</td>
</tr>
<tr>
<td><strong>Course duration</strong></td>
<td>Two to three years or upper secondary graduates. Three to five years for lower secondary graduates.</td>
<td>Three years or less</td>
<td>Generally three years, some two years.</td>
</tr>
<tr>
<td><strong>Eligibility for higher education</strong></td>
<td>Permitted to sit for national university/college entrance examination after two years' work.</td>
<td>Permitted to sit for national university/college entrance examination after two years' work.</td>
<td>As STS, but two-year work requirement does not apply. Success rate is, however, low.</td>
</tr>
<tr>
<td><strong>Main administrative authority</strong></td>
<td>Technical ministries through state-owned enterprises or local authorities</td>
<td>Technical ministries, Ministry of Labor and Personnel, and local bureaus and enterprises</td>
<td>State Education Commission through Provincial/Municipal Bureaus of Education</td>
</tr>
<tr>
<td><strong>Enrollment in 1989</strong></td>
<td>1,493,000</td>
<td>1,258,000</td>
<td>2,823,000</td>
</tr>
<tr>
<td><strong>Number of schools in 1989</strong></td>
<td>2,940</td>
<td>4,102</td>
<td>9,173</td>
</tr>
</tbody>
</table>

*Source: China Statistical Yearbook, 1990, pp. 655, 658 and 672.*
Secondary Technical Schools (STSs)

3.21 In 1988 there were about 2,957 secondary specialized (technical) schools with an enrollment of approximately 1.4 million students. Their primary function is to train technicians who are assigned as lower-level cadres. Because of their close ties to employers, all graduates are guaranteed jobs. The schools are managed and financed by state enterprises, central technical ministries, local education bureaus, and come under the broad supervision of the State Education Commission. Previously these schools admitted mostly upper secondary graduates, but a new policy calls for recruiting lower secondary graduates. It is unclear whether this means that all STS students are to be recruited from lower secondary schools in the future. Currently about half the enrollees come from each source. Because of the enrollment of lower secondary graduates, some programs have been lengthened from two to three years to four to five years to bring the students' educational level up to upper secondary school standards. Since graduates are guaranteed placement as cadres, the demand for places in these schools is generally quite high. Graduates of these schools, although well-qualified, have very narrow specialties and little flexibility for career or technical changes.

Skilled Workers' Schools (SWSs)

3.22 Skilled Workers' Schools are designed to train mid-level skilled workers, but often graduates only qualify for lower positions. The schools are under the overall supervision of the Ministry of Labor and Personnel, with about half their resources coming from industry. Central technical bureaus, local labor offices, and industries that require skilled employees sponsor as many students as they expect to need in the specific job classifications. This is important because of the limited scope of the training reduces the potential of graduates to be mobile and flexible as technology and industry requirements change. For example, currently the schools train many machine operators with narrow skills, but few broadly skilled machinists that can perform a wide variety of machine shop tasks. Industry observers site a shortage of more broadly trained workers, based on forecasts of future levels of production, and presumably the direction of technology and product mix. The close links between employers and schools mean that students generally have substantial internships in industry before graduation. Since the enterprise is obliged to hire all the students it sponsors, there is a reluctance to commit the firm to large numbers of new employees by enrolling large numbers of students.

3.23 Of 3,548 skilled workers' schools, 945 were run by central industrial ministries, 412 by local labor bureaus, one by the labor ministry, and the rest by enterprises. The two- or three-year training courses offer guaranteed jobs upon graduation. Graduates of these programs, are well-qualified in a narrow range of skills, reflecting the narrow classification. They are required to master relatively few tasks when compared to similar jobs in developed nations. This may be due to the overstaffing in almost all sectors to achieve full employment. Another factor may be that, over the last several decades, many job descriptions have been simplified to allow enterprises to employ less skilled workers. Although jobs as cadres are preferable to jobs as skilled workers, nonetheless the guarantee of employment is a strong attraction. In Anshan City, for example, schools reported an applicant-to-
entrant ratio of 5.9:1. In many instances, however, schools report vacant places because of a lack of sponsors.

**Vocational Agricultural Schools (SVSs)**

3.24 The most recent addition to technical/vocational education is the agricultural/vocational school, originally established prior to the Cultural Revolution to enroll primary school graduates in urban areas before they were assigned to the countryside or to factories. The current objective of these schools overlaps with the programs of other institutions: all enroll lower secondary graduates to be trained as skilled workers and cadre technicians. These schools are generally administered by local education bureaus under the direction of the State Education Commission, and thus have fewer formal links to employers. The three-year program does not guarantee placement upon graduation. The quality of the graduates varies enormously and the schools tend to be underfunded and poorly equipped to train students for more technically advanced specialties. They may be better able to provide less expensive training in the service and commercial sectors, but they face competition here from short-term contract training provided by labor service companies under the direction of the labor ministry.

3.25 There are two basic types of secondary vocational schools: agricultural schools which recruit a significant percentage of their students from primary school graduates; and urban vocational schools, which recruit a relatively small number of primary graduates.

3.26 **An Enrollment Comparison.** In 1988, China had 4 million students in technical/vocational training programs, 7.5 million in general upper secondary schools, and 0.7 million in teacher training programs. Thus 35 percent of the student population was enrolled in technical/vocational education. If in-service SWS and STS enrollments are added, the total comes to 41 percent.

Data from 20 OECD countries show great variation in the proportion of upper secondary students in technical/vocational courses (from 18.5 percent in Greece to 82.5 percent in Austria). Nine countries were below 50 percent and eleven were more than 50 percent. In Korea in 1975, 42 percent of upper secondary students were in vocational high schools. While Japan is thought to rely on firm-based rather than school-based training, 30 percent of upper secondary students are in technical or vocational programs. But these countries have very different goals and much higher overall enrollment rates in secondary and higher education. The only generalization that applies is that the developed countries have chosen highly varied approaches, both in the extent of vocational training as a percentage of the age group and as a percentage of upper secondary education.

**Informal Training Programs**

3.27 In addition to formal job training, there are also apprenticeships (well over a million currently) and preservice training by labor service com-
panies 5/ as well as some on-the-job training by industry--and to a lesser extent by collectives. The extent of this in-service training is uncertain, but these programs belong in any future plans for vocational education.

B. Proposed Reforms

3.28 Technical/vocational education in China has evolved from a highly differentiated group of schools serving three different educational levels that trained students for different needs into an overlapping system focused on upper secondary education. Additional overlap between these secondary school programs and polytechnics may emerge as well. This system is managed and financed by a wide variety of ministries, bureaus, and enterprises. Thus coordination is difficult and the government's proposed reform is a first step in attempting to give more guidance and direction to educators. There are, however, a number of questions that must be addressed to improve the system. These include the following:

(a) What are the program's objectives?

(b) How effective is the system in meeting the needs of economic development and can it be improved?

(c) What will the program cost and what would be the sources of finance?

3.29 The proposed expansion of the vocational education program to reach a 50/50 balance with academic secondary schools within five years will not automatically provide China with the kinds of skills the country requires. The history of technical education, the existing skills deficits, and the current economic and labor market situation suggest that while there are shortages of important skills, part of the solution must come about through upgrading existing workers, improving the labor allocation system, setting flexible wage differentials, and broadening training.

3.30 While some vocational training expansion is needed, the extent of the increase is not clear. Evidence on provincial differences in labor markets and on the success of the schools in placing graduates suggests that sufficient planning has not been done to determine appropriate enrollment levels. It would be helpful if local technical/vocational schools (SUSs) under the education ministry were incorporated in the planning process so that expansion plans conformed to labor needs at a provincial level. This would be consistent with the government's objectives of attempting to meet development needs and allowing inputs by employers who have an understanding of the specific job skills required. The pace of expansion should be based on the quantity of skilled manpower needed, the ability to expand without sacrificing quality, and the resources required to address other national priorities, such as basic education. Strong institutionalized planning by the government and the use of employer surveys will help project local requirement for skilled

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5/ These companies, which receive small subsidies from the government, were originally established to provide employment for workers not assigned to state enterprises. Currently, they charge a fee to trainees and to future employers, for whom they train under contract.
manpower. It is also important to prevent overlap, fragmentation, and small, inefficient programs.

School Quality and Internal Efficiency

3.31 The ability of the schools to expand and provide an acceptable level of training depends on the quality of instruction and the utilization of teachers, equipment, and facilities. The three types of schools, despite their differences in management, administration, and purpose, have similar strengths and weaknesses. The schools are highly efficient in graduating most of the students they initially enroll. In most cases, facilities and equipment are adequately maintained and teachers have appropriate academic qualifications.

3.32 On the negative side, facilities are generally inadequate and equipment is limited and outdated. Most of these shortcomings flow from a lack of resources. Schools report that only 60 percent of prescribed experiments and workshop training can be carried out with existing equipment and facilities. Equipment shortages are particularly obvious in the specialized laboratories and shops. In addition to shortcomings of physical facilities shared by many general secondary schools, such as poor lighting, heating and sanitation, serious problems arise from converting general facilities into workshops and laboratories. Teachers in many schools often lack relevant industrial and commercial experience. Consequently more time is devoted to general education than specified in the recommended curriculum. In addition, teachers rely too heavily on lectures and demonstrations. More of the same would not be desirable. Teachers need to be upgraded to increase their experience and new teachers trained. It would be useful to establish standards for specialized teachers, require training for teachers recruited from industry, and specify the training and industrial experience needed by general teachers to qualify them in specialized fields.

3.33 Typically teachers, equipment, and facilities are underutilized in all three types of schools. Overall student/teacher ratios are low by international standards. Low teaching loads and large classes are an inefficient use of teachers' time. Excess staffing is also apparent in the size of the nonteaching staff, which amounts to more than 50 percent of the total staff in the sample schools. Equipment and facilities are underutilized because all lectures take place in the morning and all labs are held in the afternoon. The number of extremely small schools, with a limited number of trainees in each specialty and a wide range of unrelated specialties compound the problems.

3.34 The elimination of some of these inefficiencies could lower the costs of existing programs and reduce the costs of expansion. If teaching loads were doubled, enrollment could be doubled without adding general teachers. Additional specialized teachers would still be required to fill the existing deficit. Whether it is feasible to double teaching loads in existing institutions is uncertain. Some adjustments in teachers' salaries may be required. Better use of existing facilities and equipment would require a shift in the organization of school programs. While this is also true of academic programs, it is especially necessary in technical/vocational schools where there is a higher concentration of specialized equipment and facilities. In addition, the proportion of nonteaching staff needs to be reduced through
consolidation of functions. Increasing school size might also cut administrative overheads.

3.35 To avoid the inefficiencies of small schools, it would be better to expand existing technical/vocational schools than to convert more schools, as proposed in the reform program. Consolidated planning for all technical/vocational school enrollments is essential if programs and schools are going to expand and fragmentation and overlap are to be eliminated. In theory the education reform recognizes this, but in practice the emphasis seems concentrated on converting more conventional secondary schools into vocational schools rather than expanding existing units.

3.36 While some expansion of existing schools is possible by improving use of the facilities, concurrent quality improvements are essential. One option might be to establish training centers serving a number of schools to capture economies of scale in the use of specialized equipment. A trial program could determine whether demand for such centers is adequate.

Cost Implications

3.37 The affordability of qualitative improvements and quantitative expansion depends on the costs and financial resources available. The recurrent costs of these programs exceed those of general secondary education but vary according to the type of specialty and the type of school. There are no estimates of the costs of alternative types of training in short-term labor service companies for comparison.

3.38 Based on current cost estimates and an evaluation of facilities and equipment, an estimate of the costs of the proposed expansion can be attempted. At a minimum, assuming no changes in the existing system, costs estimated for 1986-90 amounted to Y 12.5 billion. If the proposed expansions and improvements in quality, but not in efficiency, were factored in, the amount rose to Y 52.4 billion for capital and recurrent costs. This sum represents 1.1 percent of GNP for a tiny 4 percent of total student enrollment, compared with about 3 percent of GNP for all educational programs. This calculates and indicates the serious risks of cost escalation that can arise in an expansion. By doubling teaching loads and improving the use of staff, facilities, and equipment, the costs of current and expanded enrollments with improved quality could be halved. By sacrificing quality and facilities, the costs of the expanded system might be as little as Y 16 billion if efficiency is doubled. China is thus faced with some serious tradeoffs. It is not feasible to spend almost half of the education budget (as a percent age of GNP) to improve the quality and double the enrollment of vocational training at current levels of efficiency. Nor is an expansion without improving quality desirable. It would be better to improve quality and efficiency rather than push for a 50/50 ratio, except where it is specifically justified by local economic conditions.

6/ Recurrent costs are based on survey data. Equipment and facilities are estimated at the lowest 10 percent costs in 63 institutions in nine projects funded by the World Bank between 1981 and 1983.
C. Financing Technical and Vocational Education

3.39 The affordability of these alternatives depends on the sources of school finance, which vary according to the type of school and to a lesser degree by province. Rough calculations indicate that only 14 percent of revenues comes from central government ministries (primarily technical ministries). The largest proportion, 54 percent, comes from local governments; 27 percent from enterprises, and the balance from school-operated factories, tuition, and other sources, that suggesting that the central government has little financial leverage in directing the system (see Table 3.2).

Table 3.2: PERCENTAGE OF REVENUE FROM VARIOUS SOURCES, 1985

<table>
<thead>
<tr>
<th></th>
<th>Central Ministry</th>
<th>Local Government</th>
<th>Enterprises</th>
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<td>57</td>
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</tbody>
</table>

Source: Three Province Survey, Labor Bureau, Liaoning province.

3.40 The majority of school financing currently is for recurrent expenditures; capital expenditures are made on a more ad hoc basis. For schools run by central ministries, funds are set aside for capital and equipment. For
secondary technical/vocational schools run by the local education bureaus, the
SEdC earmarked Y 250 million in the Seventh Five-Year Plan for capital and
equipment improvement, far less than the Y 1.5 billion needed to upgrade
equipment in existing schools.

3.41 Other sources of local funding cannot be expected to provide major
contributions to expansion. Funding by enterprises is already quite high by
international standards and can only be expected to increase if more generous
tax writeoffs are given. As noted earlier, greater cost consciousness in
industry and commerce and shorter labor contracts may in fact lead to cut
backs in enterprise support for technical/vocational schools. Thus local
governments must bear the brunt of the proposed increase in costs. Local
areas differ greatly in their ability to do this. Regions that have not yet
achieved universal basic education will opt for that objective. Guidelines
and priorities for the expansion of education need to be established, at the
local level. Thus not only the need for, but the ability to pay for improve-
ments and expansions of vocational education vary greatly.

3.42 The introduction of major new taxes at the local level seems inad-
visable until the effectiveness of the programs has been improved and the
level of need can be better evaluated. A better alternative would be to pro-
ceed incrementally by providing more attractive tax writeoffs for pre-service
training by industry, schools, or labor service companies.

3.43 On a trial basis, the government might try a training tax in one
locality. Firms could either spend the specified tax on training they provide
themselves or on training contracted from others. Alternatively, they could
put the amount in a local fund to be administered for publicly provided tech-
nical/vocational education and training. This system would both raise reve-
 nues and increase employer guidance of training. It would, however, have
administrative costs and might be too heavy a tax in some areas.

D. Conclusions

3.44 Because China's technical and vocational education system developed
to serve a system under which labor was allocated to state-owned enterprises,
it has excellent employer linkages in two kinds of schools—Secondary Techni-
cal Schools and Skilled Workers' Schools. The proposed reform, however, would
expand a third type of school—the Secondary Vocational School, which has as
yet few formal links to employers.

3.45 If the expansion is to contribute to economic development, it is
essential to coordinate enrollment between the three types of schools. Fur-
thermore, enrollment levels by schools and by specialty should depend on local
labor market needs, the quality of the schools, and local priorities for edu-
cational expenditures. Expansion should occur only where high quality pro-
grams combine with substantial demand for program graduates. This means that
the pace of development will depend on local conditions and will differ among
provinces rather than conforming to the 50/50 rule locally.

3.46 A certain amount of uncertainty surrounds the effects of changes in
the lifetime employment guarantee. Where it applied, enterprises had a strong
incentive to provide specialized training. A lifetime gives employers a long
time to capture the benefits of education. But if the new system of contract
labor leads firms to cut back on training, it will give employees a stronger incentive to acquire skills.

3.47 The role of education and training in China is changing in tandem with emerging trends in wages, labor mobility, and job assignment. These changes will profoundly affect the structure of the country's labor markets.
IV. MANAGEMENT AND FINANCE OF HIGHER EDUCATION

4.1 China has achieved nearly universal basic education. But during the decade-long Cultural Revolution, few students were enrolled past the lower secondary level. As a result, only 0.5 percent of adults have a college degree--fewer in the 25 to 34 age group than in the over-35 group--although a relatively high 65 percent have a primary education. Years of isolation and the low priority placed on higher education in the 1970s have limited the number of qualified teachers. If China is to accelerate modernization in the 1990s, it will need to increase enrollment in higher education. This chapter will review how postsecondary institutions function, discuss program quality and efficiency, and look to the future.

A. Organization of Higher Education

4.2 Government goals for higher education, spelled out in the 1985 education reform proposal, are to improve academic standards, expand enrollments, and substantially enlarge the system. In pursuit of reduced costs and greater efficiency, the authorities have relaxed some tight controls on academic institutions, giving them greater flexibility in enrollment and more autonomy in management. Universities are now freer to design new courses, allocate funds for operations and capital development, appoint and remove university personnel, and develop consulting and other arrangements. They can also enroll qualified students at employers' requests or at their own expense--a turnaround from policies that limited the student body to those assigned under the state plan. Moreover, the government has agreed to give students substantial choice in job assignments.

4.3 Overall responsibility falls to the State Education Commission (SEdC), formerly the Ministry of Education. A three-tiered system of management and finance directs administration at the national, provincial, and major city levels. Thus institutions may be operated and financed by the SEdC, by education departments of central ministries, or by provincial and municipal departments. Norms and standards for both academic and administrative functions are set by the SEdC, which means that schools share relatively uniform courses of study, similar academic standards, and common practices with respect to personnel management, budgeting, and administration. Since 1978, students applying for university admission have had to pass a central admission examination.

4.4 Although adult education programs have functioned with less central guidance, administrative procedures are similar. Students are enrolled in institutions operated by education or adult education departments of central ministries and provincial or municipal government. The rapidly growing television university system is managed by both SEdC and the provincial governments.

4.5 In 1989, about 2 million students were enrolled full time in 1,079 four-year universities in China. Adult higher education programs trained 1.7 million students. China's higher education enrollment ratio has surpassed the median for less developed countries and reached 4.8 percent. For the upper quartile of developing nations, a level China aspires to reach, the ratio is 11.0 percent.
B. The Alternative Delivery Systems

Conventional Universities

4.6 National and provincial universities offer full-time studies for residential students. Although limited by dormitory capacity, undergraduate enrollment in these institutions grew by 10 to 15 percent a year through much of the 1980s but stabilized during 1989/90.

4.7 National universities tend to be specialized. The lower-division programs (the first two years) concentrate on standard science and social science disciplines. In the upper division (final two years), the schools are organized to offer training in several hundred narrow fields of study. This has several disadvantages in a period of rapid economic growth and related diversification in the labor force. It does not prepare graduates well for new technologies or equip them to adjust to changing job requirements. And such a high degree of specialization does not facilitate adjustment of educational institutions to the new knowledge and skill requirements of graduates.

4.8 The 1,075 provincial universities divide into several major categories: comprehensive (49); normal universities, for teacher education (262); sciences and engineering (282); medical (119); agricultural (59); and other specialized fields such as fine arts, physical education, commerce, and foreign languages. These institutions each enroll between 2,000 and 2,500 students and programs of study vary considerably. In larger provinces they are nearly the equivalent of a national comprehensive university. Curricula include most standard disciplines with undergraduate and, to some extent, graduate programs. Students come exclusively from the province and are only slightly less able than national university applicants, as measured by entrance examinations. They will be assigned jobs in the province upon graduation. In smaller provinces, however, a comprehensive university may have a relatively small enrollment—1,000 to 1,500 students—and offer a narrow range of disciplines. Six provinces do not have a comprehensive university.

Finally, there are close to 100 elite institutions called key universities, which enroll an average of 4,500-5,000 undergraduates selected from the national pool.

4.9 Teacher training institutions—called normal universities—are the largest category of provincial institutions, with over a third of the total number. They fall into two classes. The major normal universities offer a four-year bachelor's degree program and a few graduate programs. These institutions devote most of their resources to training upper-secondary school teachers. Students are drawn from the province as a whole. About 85 percent of the graduates actually go into education—about 65 percent into teaching. The minor normal colleges offer two- or three-year, nondegree programs for lower secondary school teachers. These institutions are structured to serve a clearly defined region.

4.10 Provincial technical universities provide programs in selected fields of science, engineering, medicine, and agriculture. These institutions fill an important need, since the national colleges are unevenly distributed among the provinces and the national system of graduate assignment tends to satisfy first the requests of central agencies. As a result, provincial demand for manpower can be satisfied only by graduates from the provincial
universities. Particularly in public health and agriculture, varying conditions among provinces call for specialized training.

4.11 As Chinese planners proceed to expand the network of conventional universities, they will face the choice of establishing new institutions or enlarging existing ones. This form of higher education is, quite clearly, the backbone of the system. A strong network of conventional universities will inevitably set standards throughout higher education. But conventional universities are also the most costly component of higher education, representing as much as 78 percent of total government expenditures on higher education.

Polytechnics

4.12 These new postsecondary institutions fill a serious gap with two- or three-year courses to train mid-level technicians. Their technical education helps satisfy local manpower requirements. It also provides access to higher education for students who fail to secure a place in a conventional university after taking the national entrance examination. In 1985 there were over 80 polytechnics in operation. In contrast to conventional university graduates who are assigned jobs, graduates of the polytechnics have no guarantees. Local employment services assist them, however, and their rate of employment tended to be close to 100 percent although it declined during 1989/90.

4.13 Polytechnics incorporate several innovations. (1) Few residential facilities are provided, which overcomes a principal constraint on enrollment in conventional universities and eliminates a major cost factor. (2) New sources of funding are being tapped, including a combination of student fees and municipal and provincial funding. (3) Curricula are being developed to make efficient use of physical facilities and staff. (4) Students receive training that is based on local needs. Close coordination with local enterprises has helped to identify priority fields of study.

Adult Higher Education

4.14 With a 45 percent share of total enrollment in higher education, China's adult education programs have a larger proportion of students than those of any other developing country. Even in the developed countries higher education for adults does not exceed 50 percent of total enrollment. In China, leaders have long viewed these programs as a principal vehicle for political and economic change. There have been several compelling reasons for this: the need for political education in the years following liberation, the imperative to develop leaders to carry out and support social transformation in cities and the countryside, and the need to raise the technical caliber of the work force in order to modernize. The relative emphasis on each of these goals has varied by period. Since the late 1970s a major concern has been the relatively low educational profile of the work force.

4.15 Adult education courses are intended to improve workers' skill by upgrading some students to the level of university graduate, by providing university graduates and management personnel with some knowledge of modern science, technology, and management, by increasing the proportion of engineers and technicians, and by offering all cadres short courses on management and technology. There are primarily three versions of adult education programs: full-time (employees are released with full pay and benefits for up to
three years), part-time (in-service training typically amounting to short-term courses), and spare-time (four to six hours a week in addition to regular working hours). Courses are offered via television, universities for peasants and workers, institutes for teacher training, and evening and correspondence programs.

4.16 **TV Universities.** The TV university system grew in the early 1960s to train science teachers, then closed during the Cultural Revolution. It resumed broadcasting in 1979 with the establishment of a Central Radio and Television University (CRTVU) and 28 provincial television universities (PTVUs). These operate 500 branch schools, study centers, work stations, and TV classes in factories or work units.

4.17 The CRTVU broadcasts 33 hours of educational programs each week, through the national television network. It also distributes audio cassettes and booklets to TV classes and organizes examinations. The curriculum has 28 courses in science and technology and two courses in social sciences and arts. A few PTVUs offer additional courses of their own. Television lectures are supplemented by face-to-face tutoring at work stations; instructors are recruited from facilities and nearby higher education institutions.

4.18 In 1989, registered enrollment was 417,000 students. More than 90 percent of the students are employees of factories and other government units who have passed an entrance examination. About 50 percent of the full-time students are released from work to attend classes. Many of these are recent secondary graduates who have taken the entrance exam for admission to conventional universities and scored just below the cutoff point. In addition, an estimated 5 to 6 million free viewers—unregistered students—watch such courses as English-language programs.

4.19 **Workers' Universities.** Workers' education programs began toward the end of the Cultural Revolution to accelerate production. Under the guidelines, workers are guaranteed at least four hours for spare-time study a week. With approval, they may schedule full-time study. Many large-scale enterprises and technical bodies under state ministries offer university-level courses. At the end of 1988, there were over 800 such colleges with 289,000 students. In addition, some provincial and municipal bureaus of education and certain universities offer programs directly tailored to the urban adult worker. Enrollment varies from institutions with less than 200 students to those with 5,000. Admission is increasingly selective.

4.20 There is no standard course structure and vast differences exist in the content, quality, and intensity of the programs organized by different units. Students are generally required to devote a substantial portion of time to basic theory. Project assignments are designed with reference to a student's responsibilities at the work place. External monitoring of courses and student achievement is encouraged by state education officers. Since most workers' colleges are run directly by factories, mines, enterprises, or trade unions, the chief purpose is to raise the economic performance of the worker's unit. Specializations are geared closely to the firm's requirements, and graduates return to their assigned jobs following training.

4.21 **Correspondence, Special, and Evening Programs.** Correspondence education is recognized for degree purposes and is an acknowledged method of pro-
viding cost-effective education. These programs have a few full-time teachers supplemented by university and part-time staff members at off-campus correspondence stations. The academic content varies according to the specialty of each university. Course length is from three to five years. Successful students will have devoted 4,000 to 5,000 hours to studies before attempting final examinations. This is a heavy load and student dropout and failure rates are high. It is reasonable to assume that only 50 to 60 percent of these students successfully complete their programs.

4.22 In large urban areas, universities also offer special short-term courses and evening programs. These courses are either for students formally registered for a degree, as in the correspondence program, or for those seeking specialized coursework in a field in which the institution has expertise.

4.23 To the degree that these programs are adjunct to regular full-time university programs, there are several advantages to this approach. By comparison with independent programs, quality control is more assured in that courses are managed by mainstream universities. Teaching personnel, educational materials, equipment, and facilities conform to those provided in the universities. And evening courses use space that in many institutions is wasted.

4.24 These programs are administered by a great number of government and nongovernmental agencies under the direction of SEdC. Most agencies have considerable autonomy; decisions on curriculum, academic standards, teacher qualifications, and provision of facilities are resolved at the local level. The SEdC directly manages only the operations of the central television university and the extramural programs offered by key universities of the central government. At the provincial level, policies are executed by provincial departments of education; at the national level, each technical ministry has an education department responsible for adult education as well as programs for employee training provided by individual enterprises in the sector. Because of this diversity and decentralization, detailed information is sketchy. In 1988, total enrollment hit 1.7 million students, just below the 2.1 million enrolled in standard university programs, with 82 percent of the students in programs equivalent to two- or four-year college courses. The most rapid expansion has been in the television university system, which serves as an open university to meet a variety of needs and groups, and in special, correspondence, and evening programs operated by universities and polytechnics. Enrollment in worker and peasant universities, popular during the Cultural Revolution, has been static in recent years.

C. Demand for University Graduates

4.25 China has embarked on an ambitious long-term plan for economic development that aims at quadrupling output by 2000. Concurrently, there are plans for rapid development of education.

4.26 At issue is whether higher education can meet the broad human resource demands of growth and substantial structural change in the economy. A related question is whether there will be an imbalance in the number of graduates and the number of jobs in key specializations. Planning the level and composition of expenditures on higher education should be linked to manpower needs. But in other countries, forecasts based on estimates of require-
ments provided by employers or on complex planning models have not been particularly successful. The difficulties of manpower forecasting in China are mitigated by the diversity of postsecondary education—which offers several routes to any given qualification. But this diversity is offset to some extent by excessively specialized fields of study. Moreover, the consequences of error could be serious in China, at least if skilled labor continues to be administratively allocated. In other countries, inaccurate manpower forecasts are less worrisome, because both individuals and enterprises can respond more flexibly to labor market opportunities.

4.27 At present, evidence indicates impending shortages in certain major fields. These shortages are particularly acute in management, economics, finance, law, administration, and health.

4.28 The size of the university-age population in China will decline in the 1990s and level off in the first decade of the next century. But there will continue to be a large pool of graduates desiring a university education because of low enrollment ratios in the 1980s and because the planned secondary level enrollment ratio will itself reach about 70 percent by the end of the century. The output of university graduates will be constrained only by the amount of resources that can be devoted to higher education.

Recurrent Costs of Universities

4.29 In considering future policy for higher education, it is important to look at today’s cost structure.

4.30 Personnel. Costs associated with personnel account for slightly more than a third of total expenditures. Although this is well below the norm—personnel costs in other countries commonly run 60 to 70 percent—an increase in the student-teacher ratio could significantly reduce costs. Higher salaries would increase operating expenses but could be balanced by adjusting the student-teacher ratio. The ratio in Chinese universities that provided data for this report is 3.7 to 1, while the average for universities in East Asia and the Pacific is about 12 to 1; in the United States 15 to 1; and France 25 to 1. Chinese officials are already beginning to back away from their costly policy. Hiring new faculty members is more restricted; present faculty are being upgraded; new policies for retirement are in effect; and teaching loads are increasing to 15 to 18 hours a week. At the same time, there has been some increase in salaries, in part as compensation for increased workloads, and in part to improve the status of teaching and attract able and qualified personnel.

4.31 Student Housing. The costs of operating student residences and providing fellowships, subsidies, and food allowances amount to about 20 percent of total university expenditures. For institutions operated by provincial governments, these costs are higher—23 percent. Student housing is considered necessary given average housing standards and the relative lack of alternative arrangements for students. But alternatives have proved possible in the case of polytechnics that provide no residential accommodations. And a few universities have already recognized that excess demand from qualified applicants could be satisfied by allowing students to make their own housing arrangements.
Fees

4.32 In the past, full-time university students were not required to pay fees or charges, but since 1987 tuition fees have been introduced for those able to afford them. Other students who enroll in night courses, short courses, and correspondence courses are also charged fees. In some cases, the students pay these charges, in other cases, enterprises pay fees for their employees.

4.33 There are sound reasons for some movement in this direction in higher education. The gradual freeing of the urban labor market will likely increase the benefits that accrue to university graduates. In addition, students and families can tolerate fees at the postsecondary level, as has been demonstrated by the expansion of fee-charging, nonresidential polytechnics and of specialized university courses that require fees.

4.34 At the higher level, fees and related expenditures are still fairly small in relation to total expenditures per student. At the primary level, particularly in rural schools, fees and related charges to households may be a significant share, about 30 percent, of total expenditure per student. Lower secondary students who must live in residences, particularly in some rural areas, need Y 50 to Y 60 for food and related requirements. In contrast, residential students in many upper secondary schools and in universities are supported entirely by state subsidies.

Capital Investment in Plant and Equipment

4.35 Efficient management of higher education involves not only measures to reduce operating costs but also efforts to improve the productivity of capital investment in plant and equipment. The financial requirements for facilities and equipment will compete with outlays for faculty training, educational materials, or libraries. These claims on available resources will force hard choices in allocating university budgets.

4.36 Facilities Planning. China's facilities standards are essentially based on a per-student space allowance. This space allowance is subdivided into shares for each major category of facility. Nonacademic facilities for support and service functions are a significant share of total space allocation. For example, faculty housing, dining halls, and schools for children of employees account for 32 percent of the total space allowance for science and engineering undergraduates. If allowance for student dormitories and canteens is added, this category accounts for 50 percent total space. This reflects a pattern since the 1950s of "closed" institutions--those that are nearly self-sufficient in the provision of supporting facilities and services, including faculty and staff housing, schools, health-care facilities, printing plants, and other services. While the relative lack of adequate supporting services originally necessitated this policy, the Chinese economy is beginning to provide some alternatives.

4.37 The use of fixed per-student space standards is simple and provides a common guide, but the rigid application of such standards is inefficient. Requirements are changing because of the need for higher student-teacher ratios, the growth of sponsored research, increasing numbers of nonresident, commuting, and part-time students, and the provision of some supporting ser-
vices from sectors outside the university. An inflexible space standard based upon student enrollment cannot adequately provide for these variations. The standards for many categories generally appear to be reasonable and in some cases even austere, yet some may actually provide more space than needed. A comparison of classrooms and teaching laboratories in World Bank projects in other developing countries, or in a set of comparator developed countries, suggests that China's space standards could be reduced. This reduction could lower per-student expenditure on facilities by about 20 percent.

4.38 Construction. Since late 1984, the government has ordered competitive bidding for construction projects. Bids come from local construction units and from those in other areas. So far, experience in Tianjin and Shanghai has been salutary. Savings have been estimated at 10 percent with construction completed on schedule. In other areas, this approach has not been feasible because of the ongoing boom in construction and the scarcity of materials and skilled labor. If shortages can be resolved, this approach will help reduce the costs of construction.

4.39 Utilization. New guidelines for classrooms and laboratories call for utilization of six hours a day per classroom and eight hours for laboratory space. These standards are not always met. Visits to several universities indicate that actual teaching time in classrooms is about five hours a day and in laboratories about four hours.

4.40 Under the traditional method of classroom utilization still employed at many institutions, each class of students has its own permanent classroom. All classes take place in that classroom, and the space is also used for study. At larger institutions or those universities where enrollment growth has exceeded the availability of classroom space, available rooms are assigned for each actual class requirement. A more flexible classroom system is difficult to arrange at many institutions because they lack alternative student study space. Dormitory rooms are not adequate. Some institutions have large study halls or use lecture halls. This system permits more intensive utilization of available classrooms. The use of library space for reading and study is effectively restricted at many institutions by the relatively limited number of open hours.

4.41 A survey of several institutions showed that the utilization of classrooms and laboratories is higher in the morning than in the afternoon. Virtually everywhere there is a long lunch and rest period when classroom and laboratory facilities are not in use. Nor is space used in the late afternoons, evenings and weekends. If the schedule were modified—by scheduling classes throughout the morning and afternoon, by staggering the lunch period—schools could serve a much larger student body.

4.42 Institutions that centrally manage classroom assignments achieve a higher level of utilization, and this could be made the standard procedure. The use of computers, increasingly available to all institutions, could greatly simplify the scheduling process.

Fiscal Management of Universities

4.43 Until recent years, revenues for universities and other institutions of higher education have been almost exclusively governmental. These sources
include the SEdC, the provinces, and technical ministries and agencies at national and provincial levels. But many institutions, particularly larger or specialized universities, have begun to develop new sources of revenue. These derive from the acute need for specialized and technical personnel and the willingness of major firms and government entities to finance employee education. Many of these units have developed contracts with universities to train their personnel. At one comprehensive university, businesses have agreed to pay Y 2,000 per student per year for training in special courses. Of this Y 2,300, Y 1,300 is used by the university to cover operating expenses and Y 1,000 is set aside for capital construction.

4.44 Increasingly, government units and enterprises require consulting and research services in fields such as technology development, marketing, application of computer technology, and management. Many universities are able to provide assistance, and government units and enterprises are contracting for these specific research needs.

4.45 There are other sources of funds for universities: profits from the sale of books and materials, receipts from the operation of dining halls and guest houses, and revenues from operations of general stores. Many institutions operate printing presses for textbooks and other instructional materials. As a part of student laboratory training or faculty research, some universities have also created "factory sales," the manufacture of specialized equipment in demand by other institutions. Private gifts or contributions also come from overseas Chinese, graduates, or enterprises.

4.46 These nontraditional revenue sources amount to a small share of the operation of most universities. The government will continue to provide the major portion of university revenue. But it is desirable for all universities to consider developing alternative sources of funds.

Fees and Equity Issues

4.47 It is difficult to gauge the social effects of an increase in the proportion of nonresidential day students, cutbacks in student subsidies, and fees for some students. Experience other countries indicates that subsidies in education are often distributed inequitably. The relatively few individuals able to attain higher education receive large unit subsidies compared to those who attain lower levels of education and the financially better off are overrepresented in the secondary and tertiary levels of education. One way to increase the equity and efficiency of a public education system is to impose selective charges at higher levels of education, as is being done and redistribute the revenue to lower levels.

4.48 An important caveat concerns effects on poorer students. Some students may be forced to leave school; others will be discouraged from applying for university admission. Again, such adverse effects are being partially mitigated through the provision of selective scholarships or educational loans. China is moving further in this direction: the education reform act proposes more scholarship assistance for needy students and full-cost financing for selected students.
D. Conclusion

4.49 China faces rising demand for tertiary level manpower in a number of fields and if this is to be met the financing needs of university education will require continuing attention. Financial constraints will have to be tackled by reducing overheads and costs per student as well as by generating additional revenue. Universities can trim their capital costs by lowering the generous space standards per student and increasing the efficiency of construction procedures. They can reduce operating costs by adopting more frugal personnel policies which bring the staff-student ratio closer to international levels and by limiting their outlay on student housing. Finally, universities can increase fees where justified by a means test and redouble their efforts to earn income from consulting or external training services. In short, the ability to satisfy educational needs depends not only on budgetary allocations but also better financial management by universities, greater use of fees and a degree of entrepreneurship on the part of various university departments.
5.1 Almost alone among developing countries, China delivers a full set of textbooks to every student each semester which is a major factor in the effort to upgrade human capital. This has been possible because of modest book production standards and rigid limits on the number of available titles. There are adequate and affordable copies. But the books are flimsy, poorly printed, and lacking in graphics and attractive layout. Long isolated, Chinese educators are often out of touch with recent knowledge and teaching methodologies. Scientific and technical works do not reflect new advances. To improve instructional quality, the government proposed to upgrade textbooks. But the cost will be heavy. Decisions must set priorities that are realistic but imaginative enough to meet the challenges of the 1990s.

A. How the System Works

5.2 China’s publishing industry is large by any standard; more than 6.2 billion books were sold in 1988, and roughly half were texts for school use. Textbook production is so important that it holds priority over all other publishing—including newspapers.

5.3 Textbooks for universities and polytechnic account for 80 percent of all titles. In number of books, primary and secondary texts make up 90 percent of the total. The average primary and secondary student gets 13 textbooks a year, a number comparable to that in developed countries. At the college level, students require 10 texts annually, but only a third of them are published volumes.

5.4 Several key policies govern textbook provision:

- All students at all levels—approximately 200 million young people—must have their own new copies of all required textbooks. Typically, schools and universities purchase the texts and sell them to students at cost.

- The price is set to recapture fully the production cost and to provide a minimal return to the publisher.

- To make books affordable, textbook prices are kept as low as possible.

- Printing and distribution of texts take precedent over other printed materials so that school books arrive by the beginning of each semester.

5.5 At primary- and secondary-school levels, there is rarely more than one official textbook for each subject and grade, a degree of uniformity not inappropriate in a country as large and diverse as China. The books now in use were prepared in the late 1970s and are out of date. Almost all titles are printed on thin letterpress paper, similar in quality to newsprint. The covers are scarcely heavier than the inside pages. Under classroom conditions such books deteriorate quickly. Of university texts, about 70 percent are
mimeographed copies of lower production quality than published books; typically, these texts have not been edited.

Distribution and Production

5.6 Xinhua Shudian (XHS), a state-run monopoly, handles textbook distribution. It is surely the largest book distribution chain in the world, with 8,500 retail outlets and a further 100,000 book agencies. More than 200,000 people staff these operations. Virtually all textbook manufacturing is scheduled according to yearly plans, and XHS plays a key role in shaping these. Twice a year, XHS outlets at universities and colleges estimate their book requirements and send them to six regional distribution centers, which forward them to publishers. The printers produce to order; there is no inventory buildup. For primary and secondary textbooks, print runs are calculated and implemented at the provincial level in close association with education bureaus. When books are ready, printers deliver them to XHS, which handles distribution.

5.7 Modest production standards, a single channel for distribution, and printing to order allow XHS to set prices low enough to be within reach of the students and at the same time ensure full recovery of financial costs. But shortcomings in the system are becoming increasingly obvious. Many textbooks, particularly for higher education, are unsuitable for the modernizing China.

Pricing Policy

5.8 Most families can afford primary and secondary textbooks at current prices. A set of five textbooks, purchased twice each year, is likely to cost a student between Y 2 and Y 3 a semester. With monthly income for urban households at Y 205, and in rural areas at Y 159, textbooks are within the budget. Moreover, various sources of support are available to the few students who cannot afford to buy textbooks.\(^1\) These appear adequate to ensure full textbook availability.

5.9 Students receive their textbooks at prices controlled according to a formula. The per-page price varies by type of paper and type of printing (for instance, monochrome letterpress or multicolor offset). The basic price for standard printing of primary and general secondary school textbooks in 1986 was Y 0.08 per printed sheet (equal to 32 printed textbook pages of standard format), plus Y 0.40 for covers. Per-page prices for technical secondary and higher education textbooks are higher as a result of smaller print runs. Prices for supplementary books and reference works are also set by formula and vary from Y 0.11 to Y 0.23 per printed sheet. These prices have changed little during 1987-89.

\(^1\) Provincial education bureaus subsidize textbooks for minority populations. Some schools have small factories or other income-earning activities and use part of the income to purchase textbooks for students in need. Universities routinely subsidize the production of mimeographed texts and supplements in order to keep prices to students low.
Prices, planning, and allocation are all changing in the wake of economic reforms. The features that affect the textbook publishing industry may be summarized as follows:

- Prices and resource allocations are gradually being freed from government control at various levels so as to respond to market signals. Quotas and controlled prices will be retained for inputs to essential goods, including textbooks, which means that paper will continue to be provided at below-market prices. Guided marketing is replacing mandatory planning for other categories of goods, including general publishing.

- Enterprises are financially accountable, which means they must cover costs through receipts from sales.

- Enterprises can retain profits after taxes, an incentive to improve performance.

- Capital requirements, previously provided on a grant basis from parent ministries, are progressively met by the enterprises through retained profits and loans.

These new policies cause peculiar difficulties for textbook publishers. They face strong pressure to make a profit in a situation where prices of some inputs are rising but prices of textbooks--but not reference works and general books--remain fixed. These circumstances create an incentive for publishers to expand their more lucrative publishing options as a means of generating profits.

B. Government Objectives for Primary/Secondary Texts

The government has adopted ambitious plans to upgrade textbooks. Work has been underway on a new cycle of texts for primary and secondary levels for use in 1991. The upgrading involves improved book quality, added color, improved content, and a wider variety of texts. Improving the educational quality and effectiveness of textbooks is an important element in the attempt to achieve universal education through the ninth grade by 2000.

Improving Production Standards

China's textbooks look dreary. Pages are small, margins narrow, and layouts crowded. The books are printed on such low-quality paper that it is difficult to reproduce drawings and pictures, a serious shortcoming in books for young children. Color is absent. Yet research has shown that the use of color improves the attractiveness of books, which can significantly aid learning in the lower grades.2/

The judicious use of color has been shown to enhance instructional effectiveness by highlighting differences and clarifying illustrations, by identifying salient information, and by motivating children and helping them retain information. Reviews of the literature can be found in:

Improving production quality raises the issue of using books only once. Many other nations, rich and poor, produce sturdy textbooks and allow—or require—reuse. In some countries, schools own the texts and loan or rent to students. An alternative strategy is to sell to students. In this case, an active second-hand market develops to reuse books. Multiyear use makes sense economically, but such a change would come at the cost of practices that China now values. In the Chinese view, student ownership of textbooks increases the effectiveness of instruction because new texts stimulate student interest, are valuable in studying for later examinations (particularly in the case of language texts) and permit students to write in their books as an aid to learning. Textbook ownership also brings books into homes that may have few or none.

Upgrading Content

The pedagogical effectiveness of textbooks depends upon how well the material meets learning objectives set by competent authorities and achieves an appropriate level of difficulty. The material should be presented using instructional strategies congruent with the capabilities of teachers. These objectives can be met by using well-trained authors who incorporate into their work the results of research and who use suitable trial-testing procedures.

Chinese authorities have centralized the preparation of primary and secondary texts. The process is as follows. The staff of People's Education Press (PEP) research, write, and edit manuscripts on the basis of the syllabus and pedagogical guidelines laid down by the State Education Commission. A new manuscript is produced in a trial edition and used for a full semester in specially designated schools. The procedure begins in a few classrooms in Beijing. After revision based on feedback from teachers, the book goes to a larger number of classrooms nationwide. During the trial period, panels of experts—subject matter specialists, teachers, and administrators—review the texts.

These procedures have been developed because of frequent complaints. Teachers may find the texts too difficult or too sophisticated for students; perhaps the content is inappropriate or uninteresting and the explanations are unclear. Some of these difficulties are best addressed by having different texts for different localities. Some shortcomings, however, can be reduced by the use of more rigorous trial procedures and by taking particular care to test the books in ordinary, not advantaged, schools. International experience has shown that achievement tests are not a useful tool for evaluating the effectiveness of textbooks except under controlled conditions, and even then they do not provide the kind of detailed information most useful for guiding revision. For this purpose, it is best to have detailed and systematic reporting from classrooms chosen to represent the diversity of the school population.

Increasing Variety

5.18 The overwhelming majority of textbooks for primary and secondary education are the "unified" books published by the PEP. There are also books for ethnic minorities—about 5 percent of the population—and these are generally direct translations. Provincial education bureaus or educational publishing houses do this work; they also produce texts for Chinese as a second language. One province takes the lead for each minority language, of which there are more than a dozen used for instruction. Inner Mongolia produces books in Mongolian and ships them to Xinjiang and other areas with significant Mongolian populations. Xinjiang makes books in Uygur, Khazak, and three other languages, and these go as needed to neighboring provinces.

5.19 Experimental textbooks are developed by schools, teacher training colleges, or other agencies. After local trials, they can be certified by education officials and purchased directly from the developer by other schools. For example, the Jingshan school in Beijing, a well-known experimental school, has published 37 textbooks and 9 teachers' reference books in algebra, Chinese language, calligraphy, computer science, fine arts, music, and sociology. More than 60 such sets of course materials are under development, testing, or evaluation, but the volume of books involved is small.

5.20 On the whole, Chinese educators are dissatisfied with having only a single approved text series for the entire country. The need for variety is being addressed in two ways. First, provinces are being encouraged to develop supplementary materials designed to reflect local conditions and needs. Second, the authorities are stimulating competition among authors and publishers to elicit multiple texts. Publishing bureaus or schools are to submit locally written and tested manuscripts to a committee for review. All those books accepted will be authorized for use anywhere in the country. A serious problem is the time required to pilot test a book series before it is eligible for committee review. Present procedures appear to require a decade to meet all local and provincial prerequisites.

C. Publishing University Texts

5.21 Publishing for higher education is much more complex operation because of the large number of titles and the relatively small print runs. Plans called for dramatic increases in the number of published titles, from 2,000 a year in 1985 to 6,500 in 1990. In addition, specialists are modernizing content, improving the presentation of technical material, and diversifying the distribution system. Providing texts with different difficulty levels and approaches is crucial for universities and colleges. Students studying in highly selective institutions can handle more sophisticated material than average students, and texts should be appropriately designed. The content of basic courses, like mathematics or physics, that serve as prerequisites for advanced specialties should reflect the specific requirements of the specialties. China has not achieved this type of differentiation. Textbooks for higher education are written by subject specialists under several arrangements. Professors prepare the majority of manuscripts for their own courses. Most of these manuscripts are mimeographed for distribution on a single campus, though each year a few are selected for publication by university presses or by the government. Manuscripts are approved before publication by "compiling committees," of which there are about 160. More than 5,000 professors,
many distinguished in their fields, serve on these committees, which also com-
misson manuscripts.

5.22 Because of their long isolation, Chinese authors are on occasion, out of touch with advances in subject matter and pedagogy in other countries, particularly in science and technology. Continued Chinese investment in intellectual resources--books, films, tapes--as well as in linguistic skills can increase the rate at which new knowledge is incorporated into education in general, and textbooks in particular. At present there are 13 foreign refer-
ence book centers--each specializing in a different subject area--to service more than 100 publishing houses producing college-level texts. The centers represent an important resource for textbook authors but much more must be done.

5.23 In all societies, textbooks that present scientific or technical material rely heavily on diagrams, illustrations, and photographs. To be effective, the graphic materials in such texts must meet high standards of clarity and be faithfully reproduced. Chinese textbooks fall short in both respects. Plans to increase the weight of paper and to shift to offset print-
ing will help solve some problems, but use of larger page size to permit improved page design will also be important.

5.24 At least two problems plague the distribution of textbooks for higher education. The tradition of mimeographing books on each campus has led professors to use their own manuscripts in preference to published books that have been edited and are generally of higher quality. The distribution system has also been an obstacle. Books constitute only 5 percent of XHS's business, and the university presses believe that their output will not be marketed energetically enough. XHS gives universities and colleges little more than the title, author, and a very brief description of the books available, hardly enough to make an informed decision. In response to the relaxation of con-
trols in recent years, publishers have begun to establish their own retail shops, and university publishers are going into the mail-order business. A new consortium of university presses markets its own books; this will provide an important channel for improved distribution.

Upgrading Technology

5.25 China's college textbook manufacturing is organized much like that of other nations. That is, publishers contract with printing houses for type-
setting, printing, and binding. But the system for primary and secondary texts is quite unusual. These are typeset in lead type, and molds (called paper matrices) are made in multiple copies for nationwide distribution. Each paper matrix serves as a template for recreating the lead type for letterpress printing at the local printing house. The paper matrices, which can be used

3/ Somewhat unusually, the publishers purchase paper for delivery to the printing house. This means that publishers cannot exercise direct over-
sight and printers have no incentive to store the paper carefully and use it frugally.
two or three times, are purchased as needed. The enormous task of printing millions of books is shared around the country; this reduces the difficulties of distribution.

5.26 Upgrading Typesetting and Printing. Almost 90 percent of China’s textbooks are typeset by hand. Because there are about 5,000 characters frequently in use, the task is tedious and slow. One typesetter can set about 8,000 characters a day; a typical higher-education text with about 300,000 characters would take close to 40 days to set. Lead type is bulky so that storage of set type between editions is not practical. When revisions are made, therefore, entire books must be retypeset. Two other technologies are available; both are faster and allow storage of typeset text so that revisions can easily be made. Phototypesetting, currently used for 10 percent of textbooks, is a medium-level technology that works much like a Chinese typewriter. A more advanced technology, laser typesetting, is computer-based. Chinese characters are constructed by computer from input typed on a keyboard. [There are many different input schemes, some based on pinyin (a phonetic spelling of Chinese), others based on the strokes that make up Chinese characters.] The government intends to shift to laser equipment, the technology of choice for the Chinese language with its thousands of characters. But this shift will not be completed until well into the 1990s, and in the medium term ordinary phototypesetting machines are likely to play a major role in mechanizing typesetting.

5.27 Offset presses print only 10 percent of textbooks; the rest are printed on letterpress. Offset produces sharper print and much higher quality illustrations, but requires different paper. While better standards can be obtained by shifting to offset printing, a major constraint is likely to be the availability of offset paper, which is not only heavier but also specially treated. There is debate about locally manufactured versus imported equipment, about the appropriate level of technology for different types of enterprises, and about which enterprises should have the capacity for color printing.

5.28 Chinese printers prefer imported printing equipment, but domestically manufactured equipment has several advantages. It is rugged and familiar, easier to maintain, and costs less than half as much as imported equipment. Without a significant expansion of machine-building capacity, however, the demand for offset printing presses cannot be satisfied.

5.29 Upgrading Mimeographing. The government's objective is to eliminate mimeographed materials in due course. Meanwhile, students must suffer. Mimeographed materials have indistinct illustrations and fuzzy print. Because the ink spreads, it is commonplace to use only one side of the paper. Better paper would overcome some difficulties. If the government allocated adequate and appropriate paper stock to universities, it would save them from the uncertainties of the open market, which often has no paper of quality. This would also permit the use of both sides of the paper, which would substantially cut costs. Several small-scale technological improvements could

4/ Paper matrices are satisfactory when printing by letterpress. For offset printing, film images of the typeface are required. PEP is now producing film for those provincial printing houses able to use it.
upgrade mimeographed books. Electronic stencil makers would eliminate the need to retype stencils that wear out. Small offset presses may be an economically feasible technology for improving printing quality. Microcomputer software suitable for desktop publishing is becoming available. It is an affordable means of producing high-quality original copy, which can then be mimeographed using electronic stencils or printed using a small offset press.

**Pricing Formulas and Financing**

5.30 The financial aspects of textbook production and sale have worked well in the past because of the stability of prices and the availability of government subsidies. As new production standards are introduced, however, prices will have to be raised to cover publishing costs. Under the prevailing formula, which sets textbook prices in relation to production costs, the student pays just under half the cost and the government pays the balance. If these pricing and cost formulas are retained, the proportion would be maintained at the same level. But as prices rise, support for the poorest households may become necessary. It is unclear to what extent the projected costs of textbook upgrading could be lowered by switching to full-year and multiyear texts, but some savings would result.

5.31 In the lower grades particularly, the projected production costs of upgraded books are high, up to 125 percent for books with color and 110 percent for books with heavier paper and better covers but no color.5/ If texts were used for three years, for example, the total annual cost would be reduced because only a third would have to be printed and distributed each year. In light of the strong preference for student textbook ownership, however, authorities will probably retain the present system. Some trial use of multiyear texts would give some indication of how well this practice is accepted.

5.32 The textbook pricing formula is intended to cover the full financial cost of textbook raw materials, manufacturing, and distribution while keeping prices as low as possible. It does not quite meet the first objective, which means a subsidy of about 4 percent of the sales price of a textbook. Given the volume of textbook production this translated into annual subsidies of over Y 30 million in the late 1980s.

5.33 Implementation of the proposed upgrading under the prevailing price/cost relationship would eliminate the losses in textbook publishing, but the increased cost would be borne by purchasers—the families of lower primary students. Whether this is a fair and financially feasible approach to primary/secondary textbook financing depends both upon the family capacity to pay and upon the desirability of recovering the full costs of the books through higher prices. In light of the figures on household income, it appears that most primary and secondary students could afford to purchase the improved texts. Even though textbook prices would triple, the total would amount to less than 1 percent of average annual household disposable income.

5/ It should be noted that the production quality of the upgraded textbooks will still be far short of the hard-bound, sturdy books used in most of the schools systems that reuse books.
5.34  The price formula for higher education textbooks is different because these publishers are subsidized by whatever amount is necessary to yield a net profit of 5 percent. Annual purchases of textbooks and mimeographed materials by university students average between Y 20 and Y 425. These purchases are reported to be manageable for all but the poorest families.

Current Production Costs

5.35  At current production volumes, primary and secondary texts cost Y 757 a year, and higher education texts Y 324 million. Together, these amount to about 4 percent of total government expenditures on education (Y 27.5 billion in 1987). Adjusting these figures to include subsidies for electricity and tax exemptions raises total costs 55 percent above financial costs for primary and secondary education, and 24 percent above financial costs for higher education. These adjustments provide a first approximation of the resource costs of current textbook production.

5.36  One possibility would be to limit primary and secondary upgrading to those textbooks that would be printed in color and thus would require heavier offset paper. The costs of this option are shown in Table 5.1. Higher education textbooks would be fully upgraded as in the government's proposal. This would assure that all primary students start school with the educational advantage of improved, multicolor textbooks, although it would defer planned improvements in quality for grades 4 through 12. Costs in 2000 would increase to Y 2,514 million, just 27 percent over the projected increase in textbook costs with no upgrading. For both levels, full implementation of the government's proposal, given growing enrollments, would raise recurrent costs from Y 1,081 million in 1985 to Y 3,209 million in 2000, a 63 percent increase.

Financing Textbook Improvements

5.37  Given the estimated costs of the proposed upgrading and the impact on individual purchasers, is such upgrading financially feasible? Since the costs of production and distribution are almost entirely recovered through purchases, the question is whether students can afford the increased costs. The proposed upgrading would raise annual per-student textbook purchases for primary and secondary schools from the average level of Y 5 a year in the second half of the 1980s to about Y 15 under the current price formula, and to Y 11 if the formula were adjusted to reflect actual production costs. If the price formula for higher education textbooks were changed to reflect the production costs of the proposed upgrading, per-student expenditures would increase from an estimated level of Y 11 per semester to Y 15; any increase in the average number of textbooks per student would tend to be offset by reduced expenditures on mimeographed materials. These increases do not appear burdensome in light of average household income.
Table 5.1: PROJECTED RECURRENT COSTS OF TEXTBOOK UPGRADING  
(in millions of 1985 yuan)

<table>
<thead>
<tr>
<th></th>
<th>Primary and Secondary</th>
<th>Higher Education</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of textbooks</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(millions)</td>
<td>2,260  2,506</td>
<td>180   630</td>
<td>2,440  3,136</td>
</tr>
<tr>
<td>Cost</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1985 production standards</td>
<td>757   840</td>
<td>324  1,134</td>
<td>1,081  1,974</td>
</tr>
<tr>
<td>Full upgrading</td>
<td>1,810</td>
<td>1,399</td>
<td>3,209</td>
</tr>
<tr>
<td>Intermediate upgrading</td>
<td>1,115</td>
<td>1,399</td>
<td>2,514</td>
</tr>
<tr>
<td>Ratio: Projected cost with upgrading</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Projected cost without upgrading</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full upgrading</td>
<td>2.15</td>
<td>1.23</td>
<td>1.63</td>
</tr>
<tr>
<td>Intermediate upgrading option</td>
<td>1.33</td>
<td>1.23</td>
<td>1.27</td>
</tr>
</tbody>
</table>


5.38 These are the most visible costs of textbook production and they are largely recovered. More relevant to the government's decisions on upgrading are the costs it finances through direct and indirect subsidies. Direct subsidies are those paid to publishers and universities. There are important indirect subsidies—the difference between financial costs and estimated real costs. Indirect subsidies are projected to grow from Y 1.2 billion in 1985 to Y 3.4 billion, or 6.9 percent, under the intermediate upgrading option, and to Y 3.9 billion, or 7.9 percent, under the full upgrading. These resource cost estimates give some indication of the extent of public support for textbook production. Because education benefits society as a whole, it is appropriate that the government subsidize essential education inputs to some extent. Moreover, the projected growth of these expenditures in the 1990s under either upgrading option is well below the 11.3 percent average growth of expenditures on education during the period 1980-85. If this cadence of expenditure growth is maintained, government outlays on textbooks in both real and financial terms would decline as a share of total educational spending.

D. Conclusion

5.39 The government is planning to produce a new series of texts for primary and secondary students and to increase the proportion of published textbooks for higher education. The major issues to be addressed are the cost of
the improvements and the pace at which they should be adopted. Under the government's plan the total costs of a primary/secondary textbook will rise 124 percent, from Y 0.34 to Y 0.76, for a four-color textbook, and 109 percent, to Y 0.71, for an upgraded monochrome text. For higher education, where the improvements will focus on improved legibility and durability, average production costs (excluding distribution) will increase from Y 1.13 to Y 1.49. Given a projected rise in university enrollments, the production-cost increase, along with the decision to diversify university textbooks and replace mimeographed manuscripts, will mean that costs for university texts will quadruple. Full implementation of the government's proposal at all levels would raise the costs of textbook production by more than two-thirds in the year 2000.

5.40 An intermediate option, to limit the upgrading in primary texts to those subjects to be printed in color--math, science, and language--and to upgrade university texts as proposed, would cut the increase to 27 percent. The pace of implementation is likely to be constrained not by financial factors but by the availability of suitable quality paper, trained personnel, and typesetting, printing, and binding facilities. Clearly, a program of gradual implementation will be more effective in meeting the needs of China's educational institutions.
VI. EPIDEMIOLOGICAL CHANGES AND THE CHALLENGES
FOR THE HEALTH SECTOR

6.1 For two decades, China has been in an epidemiological transition. Death from infectious disease in childhood and early adult life has dropped sharply. Today, the most important causes of morbidity and mortality are injuries and chronic, noncommunicable diseases--cancers, heart and lung disease, and stroke. Three phenomena contribute to the current picture. The sharp decline in absolute levels of communicable diseases raises the share of illness from chronic diseases. The population is aging as a result of population control and declines in infant and childhood mortality. The rates of some chronic diseases remain high.

6.2 The eventual impact of the epidemiological transition remains largely hidden. China's population is still relatively young. For certain risk factors, the exposure of today's middle-aged and elderly has been less widespread, lengthy, and intense than will be the case in a decade or two. The pathological processes for many chronic diseases take years to develop and manifest themselves. For some chronic diseases, exposure to risk factors results in relatively irreversible increases in the probability of premature illness and death (as one example, from some tobacco-related illness).

6.3 Left alone, the combined effects of the epidemiological transition will drive up China's annual number of deaths from 5 million (1985) to 10 million (2010) to 17 million (2030). About one-third of these deaths may be among the young and middle-aged--those who are still in very productive years. The economic costs of such premature deaths and of illness from chronic diseases will be high.

6.4 Many of the tens of millions of premature deaths can be postponed so that they do not occur until old age. And much underlying morbidity among the middle-aged population can be prevented through aggressive efforts to combat chronic diseases. China needs to make and carry out the relevant policy choices. This chapter examines Chinese health-care problems and suggests possible solutions.

A. Health Care Revolution

6.5 China's first health care revolution began in 1949 after liberation. It was successful in combatting many communicable diseases and improving the nation's health status--so much so that the chief remaining problems are the chronic diseases. Before 1950, more than half of all deaths came from infectious and other nondegenerative diseases. Even among those in middle age, infective and parasitic diseases caused more death than did chronic diseases. Today, conditions are completely changed.

6.6 China now faces two major challenges in health care. One is to eradicate communicable diseases from regions where mortality remains high--mostly remote and poor areas that lack educational, administrative, and economic infrastructure. The second challenge is to begin a new health care revolution--to control chronic disease. Responding to the first challenge will mean continuing methods already proven effective against infectious diseases: immunization, better nutrition, and improved sanitation. It will involve for-
mulating further plans to cover epidemiology, financing, and the training and deployment of health care workers. Confronting the second challenge will involve prevention of disease but also low-cost, effective treatment, rehabilitation, and care. It will particularly emphasize finding affordable ways to postpone the onset of morbidity from chronic diseases.

6.7 Economic reforms in the early 1980s have undercut the rural cooperative health insurance programs. This has had negative consequences that will make it more difficult to complete the first health care revolution. (1) Major gains achieved through risk sharing in cooperatives or communes have been lost as rural health insurance schemes have declined. (2) The introduction of fees-for-services medicine has replaced the public financing of preventive measures that played a vital role in China's past success fighting communicable diseases. This point is particularly noteworthy since shortfalls in public financing will also make it harder to implement preventive measures against chronic diseases.

6.8 With the right policies begun as soon as possible during the epidemiological transition, China can effect early declines in some diseases where the rates of illness and death are high. Even if death rates from chronic diseases remain unchanging, control of them has greater relative importance as the incidence of infectious disease decreases and people live longer; cancer, chronic artery disease, and chronic obstructive lung disease do not cause much death or disability until middle age. In addition, the absolute death rates from some chronic diseases of middle age--especially those that are smoking-related--are likely to rise dramatically over the next four decades.

6.9 The Chinese health care system is poorly prepared to deal with chronic disease. Prevention programs and agencies are underfunded and understaffed; they lack clear objectives, vision, and sustained financial support. There have been no major nationwide initiatives to limit the growing mortality from tobacco. By training, equipment, tradition, and present financial systems, health institutions and staffs are oriented toward providing curative and treatment services—not the best strategy for control of chronic disease.

6.10 China finances its health care in ways that work against development of a preventive strategy and contribute to escalating costs for treatment and cure. Aspects of financing threaten to undercut some of the social and health status gains the country has made. They may also erode equity of access to illness prevention and care. What seems necessary is the modification of some reforms to adopt new pricing policies and empower institutions with new roles and stronger central powers.

6.11 Development of a strategy against the onset of chronic diseases is complicated. Many of the risks are related to the behavior of individuals and are multifactorial and sometimes synergistic in combined effect. The pathology of some chronic diseases is still poorly understood. For a number of them, only primary prevention—the removal or reduction of risk exposure—is substantially effective. Screening and secondary prevention—actions taken after the onset of disease—are effective for only a few diseases. For those who develop chronic diseases, treatment is expensive, difficult, and often ineffectual.
Experience in other countries, however, shows that substantial premature illness and death from chronic disease can be avoided or postponed with sustained programs aimed at reducing or eliminating the main risk factors. Based on this experience, China may be able to avoid a large share of its likely future illness. Prospects of its doing so depend on national recognition of problems and sustained commitment of public funding to undertake a preventive strategy.

B. The Main Chronic Diseases

Circulatory Diseases

Over the last 20 years in China, mortality for coronary heart disease, stroke, and hypertensive heart disease has increased in relative importance. Even so, an aggressive preventive strategy might be effective, because the frequency of these circulatory diseases is strongly associated with socioeconomic factors and the distribution of modifiable risk characteristics. Large variations exist among and across population groups and across geographic locations. These variables, among others, indicate that it would be possible to influence the onset and incidence of disease. Major Chinese studies since the early 1980s are beginning to yield valuable epidemiological information. General trends and experience corroborate the West's experience that declines in circulatory disease mortality and morbidity are achievable with good primary and secondary prevention programs.

Cancers

The four types of cancers most serious in China are lung, stomach, esophagus, and liver. In such cases, secondary prevention and screening programs, surgery, chemotherapy, and radiation treatments are all of little use. Resources could be better directed at prevention—the only effective measure. Prevention must include discouragement of smoking, a general improvement in diet, and control of the hepatitis-B virus (the main risk factor for liver cancer). Without a preventive strategy, overall cancer mortality rates will worsen, almost solely because of increases in lung cancer. Control and reduction of cigarette smoking will have more impact on health status than any other factor.

Diabetes

Though not as common as circulatory diseases or cancer, diabetes is an important problem. If China continues to develop a pattern similar to that in the West, it will have between 20 million and 30 million diabetics early in the next century. Among Chinese who suffer from diabetes, disease is a major risk factor for stroke and other cardiovascular diseases. Other than obesity, risk factors for diabetes are not well understood, but many life-threatening and disabling complications are preventable. This calls for a strong program to deal with the emerging diabetic population.

Injuries

During the epidemiological transition, the relative and absolute importance of injuries has increased dramatically. Injuries are currently a leading and growing cause of premature death. Fatal injuries come from traf-
fic accidents, suicide, falls, fire, poisonings, and transport and industrial accidents. Injuries take their toll in disabilities, health care costs, and lost production and taxes. Age-, location- and sex-specific data imply that much of the burden of injury falls on young families in rural areas and that a surprising amount falls on young women. Injuries can be substantially reduced through health education, public investment to remove and reduce key risks, and regulations to control environmental, workplace, and transportation risks. Such measures are more effective than using resources for expensive trauma-care units.

C. Risk Factors

6.17 The main risk factors for China's chronic diseases are cigarette smoking, hypertension, the hepatitis-B virus, and traditional diets that involve few fresh fruits or vegetables. Other factors include diabetes, environmental pollution (particularly in some homes and workplaces), tuberculosis, and increases in animal fat consumption.

6.18 Some risk factors appear to be increasing. And the numbers of Chinese already chronically exposed are so large that even with extraordinary efforts to prevent further exposure, many people will surely develop chronic diseases over the next four decades. There will be major economic losses from premature illness and death among the middle-aged and treatment and care costs from premature and prolonged morbidity among both the middle-aged and elderly. Much health spending will be for treatments that are merely palliative and have little impact in length or quality of life.

6.19 China needs effective prevention programs to reduce blood pressure levels in the population at large and to control hypertension among those known to be at risk. Agricultural, pricing, and health education policies should encourage the development and maintenance of a diet based on grains, fresh fruits, and vegetables. There should be an improvement of the diet for certain groups and regions. High priority should go to the development of a national immunization program against hepatitis-B virus infections and programs to reduce injuries. Careful attention to cost effectiveness will be important to ensure appropriate return.

6.20 Many of the adverse effects leading to chronic disease will be attributable mainly to cigarette smoking. As a causal factor for premature adult disease and death, it overwhelms all other risk factors. Under present Chinese trends, by the time today's children reach middle and old age, more than 2 million will die each year from some smoking-related disease. Since much of this is preventable, control of smoking deserves the highest priority.

D. Smoking Control

6.21 Control of smoking is probably the most difficult but effective step China could take to improve health. Smoking is a risk factor particularly vulnerable to government intervention. Taxation, regulatory pressures, health education, and physician and community intervention programs to reduce smoking are the best means of primary prevention for chronic diseases. It may be necessary to restrain the tobacco industry from using tactics to encourage smoking. It will undoubtedly be difficult to persuade the young to be concerned
about premature mortality from smoking. This implies the need for strong leadership and public funding.

6.22 Chinese government actions toward smoking and health are contradictory. Some government agencies encourage expansion of the tobacco industry and greater efficiency and quality of cigarette production; others, such as the Ministry of Public Health (MOPH), understand the dangers and economic burdens smoking impose. The latter agencies have begun antismoking efforts modeled on those in the United States and Hong Kong.

6.23 Domestic and foreign advocates of tobacco production argue that taxes, employment, and agricultural output would be lost if Chinese smoking were reduced. Government leaders should be suspicious of arguments supporting smoking as something economically valuable. For a glimpse into the future, China can look at the disturbing experience of the Soviet Union, where unchecked domestic cigarette production has increased disease. In other Asian countries, foreign tobacco companies have contributed to the same result.

E. Future Epidemiological Trends

6.24 China's health strategy will continue to evolve in response to changing needs based on (i) the aging population profile, (ii) lifestyle, dietary, environmental, and occupation risk factor exposures, and (iii) the disappearance of the masking effects of the long incubation period for chronic diseases. It is possible to estimate the direction and overall magnitude of expectable changes in demand and spending for health care. These estimates can be made under different assumptions reflecting the effect of China's present health care strategy and of a more aggressive strategy to prevent premature death and disability from chronic diseases.

6.25 A preliminary analysis of these estimates yields a number of important points about China's epidemiological trends and potential for preventive approaches. Chronic disease control will have its main effect in middle age, while communicable diseases will take their toll among children and the very old. Very substantial shares of death at young and middle ages can be averted and will avoid economic losses--those spared in middle age will enjoy an average of 20 or more extra years of life. The mean age of preventable (and prevented) deaths will decline over time with adoption of a preventive strategy, with considerably more skewing of the distribution toward the younger middle ages. The overall effect will be a marginally older society that is substantially healthier.

6.26 The different ages at which chronic and infectious diseases generally cause death have several implications.

- Even though the control of chronic disease is important, it will not have the obvious large effect on life expectancy that control of infectious diseases has produced. Preventing a substantial portion of future deaths in middle age has a substantial effect on the odds of reaching old age but little effect on life expectancy in old age.

- Control of chronic disease does not "feed back" into the spiral of population growth because those who have reached middle age have already had their children.
Prevention of chronic disease may reduce health care costs for those in middle age but will have little impact on such costs in old age. Effects on health care costs overall will depend upon policies relating to care required to treat illness and prolong life in old age.

Control of chronic disease can improve economic productivity per person because it will increase the size of the living, nondisabled population in the productive years and extend the period of productive livelihood.

Two fundamental aspects of preventive strategies are apparent in an analysis of such strategies for China.

First, any reasonable preventive strategy will take many years to work; near-term gains in health status will be few. China's failure to initiate chronic disease prevention programs early in the epidemiological transition will mean that huge numbers of deaths and associated illnesses simply cannot be avoided later. The benefits from preventive programs will be more than proportionately reduced by tiny further postponement of their start because of the additional and larger age groups of the population that will unnecessarily be exposed to risk. China's future illness burden can thus become much larger simply through failure to initiate prevention strategies very soon. There is a strong parallel in this regard to the experience of countries that have failed to initiate family planning programs at appropriate stages--and have suffered inevitable social and economic consequences over many decades.

Second, no prevention strategy can be expected to be perfect. Most prevention programs can reduce, not eliminate, the burden of illness. Health strategy will still have to include expenditures for care and treatment facilities to cope with decades of inevitably rising demand. China's policy must therefore focus on efficiency, controlling costs, constraining demand, and developing the manpower, institutional, and financing systems that can simultaneously provide effective "illness care" services and implement long-term, aggressive disease prevention and health maintenance programs.

Overall health spending will be a function of four variables: (i) change in demand induced by changes in the population age structure (persons under age five and over age 50 are more likely to be heavy consumers of health care; the latter group has been growing rapidly, and will continue to do so); (ii) change in demand due to epidemiological shifts (a population that is more ill, more often); (iii) increased user- or provider-induced consumption of health services (because of better or worse insurance coverage, changes in reimbursement mechanisms, rising incomes and so on); and (iv) changed unit costs because of new (less or more expensive) technology or practices in health service provision.

The first two of these variables are contained in the concept of the epidemiological transition. Because China has already entered the transition and because current risk exposure is already large, health spending per capita will inevitably grow faster than the rest of the economy. The earlier an aggressive preventive strategy can begin, the less will be the future rate of growth--but most of the gains will not be realized for at least 25 years. The
The last two variables mentioned above offer scope for nearer-term savings and progress.

6.32 The main factors that may influence consumption and unit costs of health services and provide a margin of grace for China will be more effective management of hospital resources, policies for use of new health technologies, health manpower development and deployment strategies, and health financing policies. In each area, China may learn from costly foreign failures and thus develop a strategy to extract more care at a lower cost. This will involve the reorientation and strengthening of public health institutions, approaches, and principles and more attention to efficiency of resource allocation. The main issues follow.

F. Hospitals

6.33 The role of hospitals in preventing and treating chronic illnesses is of primary importance in China's second health care revolution. Chronic disease patients are already major users of hospitals. The length of stay (LOS) is unjustifiably long, occupancy rates are high, and the treatment of chronic diseases is expensive. Within the next decade, more than 20 percent of all hospital beds may be occupied by victims of crippling diseases, a rate similar to that in European hospitals.

6.34 On their own, most hospitals have become involved in screening for chronic diseases in recent years. This provides opportunities for secondary prevention—but the high cost of finding cases and the relative ineffectiveness of much secondary prevention is little recognized. Most hospitals also participate in token programs of health maintenance and primary prevention, such as those to change diet and smoking habits. Notably, smoking occurs frequently in most hospitals, even among the medical staff.

6.35 Older hospitals are in poor condition and deteriorating further because of financial pressures and a general tendency toward new capital construction. The aging infrastructure presents problems of maintenance, fire hazard, nonfunctioning equipment, deficiencies in plumbing, and even refuse. Energy conservation measures are nonexistent. Money that could be spent on maintenance is often used to purchase equipment that enhances revenue-earning capacity. In many new hospitals, design is bad and equipment and management methods drive health care costs higher.

6.36 China must certainly increase its stock of hospitals and beds. It must also rehabilitate and upgrade its existing stock of lower-level health and disease prevention institutions. When and how to do this are decisions that must include consideration of improved efficiency, controlled costs, and equitable access. The implicit demands of over a billion people, with foreseeable illness patterns, will overwhelm any effort simply to construct more hospitals and use them in the present inefficient way. Raising the price of admission to hospitals as a means of reducing demand will surely be unacceptable to generations of middle-aged and elderly who have contributed to the nation.

6.37 One or another of the changes needed in hospital management will meet resistance by those in hospitals, by the government bureaucracy, by the insured, or even by patients who pay their own costs. Continued development
of a system of Traditional Chinese Medicine hospitals and of a specialized system of cancer hospitals and infectious disease hospitals can only go on at very high costs in either money or overall social welfare. Unless there is a consensus on a new course, the massive existing system is likely to consume more economic resources with little discernable impact.

G. Technology

Problems of medical technology complicate those in hospital resources, planning, and management. Medical policies were developed to meet earlier economic and social goals; little attention went to the issue of technology. In view of likely future health needs, some policies should be examined for their effects on technology acquisition and use. And China needs to assess new medical technology with an eye to cost effectiveness and future developments that could lower investment costs.

Rational decisions about technology choices require reliable evidence. What are the results of drugs, particular surgical or radiotherapeutic procedures, longer or shorter lengths of hospital stay, diagnostic procedures, screening strategies, Chinese traditional medicines, and ways of managing pregnancy? There is no Chinese tradition of large, randomized clinical trials; these need to be introduced.

Key types of equipment are in short supply and medical devices are generally of low quality. Over the past decade, the diffusion of Western equipment has been rapid. This has led to technology investments that are questionable in view of the shortage of well-trained Chinese diagnostic technicians.

Almost all aspects of the present health care financing system reinforce tendencies toward technology expansion or enhancement, which policymakers, drug manufacturers, health care providers, and the public may mistakenly see as desirable. Along with this, the health system is reacting to price signals that emphasize financial profits by individual hospitals, a response reinforced by health care decentralization and economic reforms. These trends help explain why China's health care costs are soaring and why fewer people will benefit from services unless reforms link cost-effective technology use to health needs. The situation calls for adjustment of the pricing system.

H. Manpower

An aging population and increasing prosperity will force China to confront policy choices that have major implications for health manpower. The principal choices involve the amount of emphasis that will go to treatment or prevention, individual or group orientation, institution-based or community-based care, "high" technology or "appropriate" technology, and urban or rural populations. There will be strong pressures from health professionals and from the urban and more prosperous rural population to follow the route taken in the West: high-technology, high-cost services and institution-based care.

A detailed manpower strategy will depend on whether China can initiate an effective mix of preventive strategies, health care policies, and innovative deployment of human resources. In the medium term, priority should go to improving the quality of undergraduate training and to upgrading the
qualifications of existing health personnel. Significant quantitative improvements should be made in nursing, technical, public health, oral health, and managerial personnel.

6.44 Curricular reform can facilitate but not guarantee improved teaching at the institutional level. Educational authorities point to their obvious resource limitations—lack of adequate classrooms, audiovisual and reference materials, and qualified faculty. An even more critical constraint is institutional resistance to change; the usual barriers to new ways of thinking are compounded by vivid memories of the excesses of "educational reform" that occurred during the Cultural Revolution. There is need for a reorientation of medical education and training to include prevention of chronic diseases and large, simple randomized trials.

6.45 China's past policies have been pragmatic in using scarce manpower resources and building on strengths. Current manpower targets bear little relation to larger health objectives, however; they are linked to hospital planning and bed/doctor ratios. Planners have not devised subtargets for services, capacity, personnel, or productivity. The MOH and other national institutions may find themselves increasingly constrained in their ability to promote health manpower objectives. Public funds descend through the health system to support training programs, but most of the decision-making for allocating these funds takes place at the provincial level or even the institutional level. There is no means whereby the national level can readily direct how many health workers of a given type should be trained in a given region. China may need to resume higher-level influence over the pace and direction of developments.

I. Financing

6.46 Past Chinese success in providing effective and low-cost health services and disease prevention programs resulted partly from low factor costs and from the mobilization of cooperative and community contributions, particularly for activities fundamental for reducing epidemics, infections, and infant and maternal mortality. Priority in funding, manpower, and political attention went to disease prevention and health promotion.

6.47 In light of the changing demographic and epidemiological situation, questions must be raised about whether recent reforms are compatible with a strategy for the next half century and whether they address the need for prevention and cost effectiveness. Too often the latest reforms appear to have redirected basic prevention efforts toward revenue-earning activities and institutional concerns that only marginally relate to health needs.

6.48 The sources and channels of China's health financing are varied and complex. They include direct and indirect government spending, various types of insurance plans, and expenditures by industry, collectives, private practitioners, and patients. Government has always provided an important share of financing, particularly for capital investment, but only a modest, declining portion of recurrent costs are financed from the public health budget. As a share of total health expenditures, the publicly funded portion is becoming less important, because most hospitals and other institutions have been instructed to become self-financing entities.
At the same time, total health expenditures have been growing rapidly. The general pattern of financing during the last decade has shown a sharply increased reliance on cost recovery through insurance payments and payments by patients. This suggests inequities in access and care for the uninsured.

Three elements characterize China's health financing problems: the changing shares of the sources of total recurrent health expenditures, the growth in health expenditures in relation to the rest of the economy, and factors contributing to the changing purposes of health expenditures (price incentives, financial decentralization, and adaptation of health institutions and workers to financial signals).

Payments accounted for by budgetary sources, the government insurance system for civil servants, labor insurance for enterprise workers, and patient payments are all growing—but not equally. Although the overall contribution from each source seems encouraging in comparison to the experience in many other poor countries, labor insurance and payments from patients account for most of the recent growth; public budgetary expenditures are declining. This means that insured people consume most of the health care services, a shift that seems to reflect a skewing of health service provision away from the majority of people. Physicians and hospitals provide as much care to insured people as the market—insurance—pays for. It would appear that health institutions and local governments (through their capital development budgets) have been investing in increased capacity to serve the insured.

Data indicate that an increasing share of the budget for public health expenditures goes to higher-level hospitals and a decreasing share to township-level hospitals and anti-epidemic stations. These changing patterns reflect the epidemiological transition and the increasing demand for higher-level hospital care. They also indicate reduced resources available for disease prevention and health promotion activities, which usually are most effective at the lowest levels of the health system. And the situation may actually be worse than time series data indicate.

On the positive side, there is growing recognition of the need to constrain consumption of unjustified health services by insured persons; a number of experiments are underway or in preparation. The problem of controlling supplier-induced inflation of health costs is not yet so widely recognized. As one example, it is difficult to determine the "costs" of new medical and diagnostic technologies. Prices are often set by negotiation among hospitals, the local health bureau, and the local price bureau, based on "average costs" expected to be incurred by the provider. In general, most new technologies have fees set above their marginal costs so that hospitals accrue maximum profits and supplement their incomes through extensive provision of the service or technology. The inevitable result is that health care costs are growing with a commensurate rise in health insurance payments and fees from patients. Ultimately, fewer people are able to benefit from services provided under these conditions.

China needs to know how much it is spending on health, the sources of financing, and for what purposes. The government can only estimate these data today. As a priority, health expenditures should become a topic of research to develop a rough annual accounting system. A review of health
expenditure patterns and institutional practices may also call attention to neglect of primary prevention as the fundamental plank of health strategy. It will clearly be in the best interests of both the people and the economy if China can develop a good "health care" system rather than a good "sickness care" system.

6.55 A key question is whether it would be more practical, equitable, and economical for China to return to some form of national health insurance, with greater central management of benefits and full public risk-sharing, or to continue a decentralized approach that encourages market-driven insurance systems. This question implies China might once again decide that at least some aspects of health care are indeed a "public responsibility" and that much of their cost needs to be funded through the public budget. The level and composition of overall health expenditures should be decided in relation to the other priority claims on public resources, but they should not be allowed to occur and grow out of control through a series of relatively hidden transfers and subsidies, as now occurs. Such an approach would necessitate a significant increase in the budget for health—though not necessarily for overall health resource flows—and an improvement in planning and control systems. It would also mandate development of new sources of revenue. Fees and taxes on tobacco appear to be an obvious choice.

6.56 As in the developed countries, Chinese economic planners often are under pressure at the local level to defer to the knowledge of health care providers about what should be done in new investment and programs. Some decentralization policies appear to have gone too far; serious consideration should be given to reestablishing mechanisms for central or provincial policy direction in investment, planning, training, services, and prices.

6.57 The MOPH hopes to rely on a set of health laws or regulations to influence local authorities and institutions toward better planning, investment, and programs. Experience elsewhere has shown that the legal framework can be a relatively ineffective policy lever. Without a return to some kind of direct budgetary control—and more budget—it is unlikely that China's central authorities can limit the escalation of health costs.

J. Looking Ahead

6.58 For the future, epidemiology will need to seek out the causes of disease, describe the overall patterns and trends of disease, and study social and behavioral risk factors. This detailed approach to behavioral epidemiology will involve more careful analysis—of risk factors, of age and sex distribution patterns, and of the influence of other sectors on health risk. Public funding will be required for primary prevention programs, which should include health education, community involvement, and fundamental changes in the vertical organization of the public health system. Disease surveillance functions will need to be streamlined and tailored for use in reporting not only the chronic diseases but also the main risk factors for them. There must be clearly assigned responsibilities for chronic disease epidemiology and analysis. A powerful and well-financed health education infrastructure will be an essential element in any program to reduce the exposure to health risks for the Chinese population, and particularly to cut smoking. China will require a clear strategic framework for health management. Civil and political leaders will need to understand the framework to provide sustained support. Authori-
ties will have to define problems, set objectives, design programs, and evaluate the results on a continuing basis.

6.59 Programs to reduce some of the risk factors will affect vested interests as well as cultural tastes and habits. To make any progress against most risk factors for chronic disease, a cooperative and integrated approach will be necessary in a variety of sectors--health, education, nutrition, population, and sanitation--China must mobilize both traditional Chinese and Western medicine.
VII. THE CONTRIBUTION OF WATERWAYS AND COASTAL SHIPPING
TO CHINA'S TRANSPORT SYSTEM

7.1 For thousands of years, waterways have provided the major means of
transport in many Chinese regions. Inland waterways and coastal shipping con-
tinue to play an important role in the economy. Yet their modern potential
has not been fully developed.

7.2 The government's often-stated goal is to "double and redouble" the
gross value of industrial and agricultural output by the year 2000. Inade-
quate transportation is a major bottleneck, however. Improved waterways and
coastal shipping would greatly contribute to modernization. Better east-west
waterways can help expand development westward from the coastal provinces.
And improved coastal shipping can facilitate trade among major industrial cen-
ters such as Dalian, Tianjin, Shanghai, and Guangzhou.

7.3 Basic requirements for an upgraded water-transport system include
careful, coordinated planning and adequate funding. But in addition, China
needs price reforms. These would put water transport on an equal footing with
other modes of transport and attract more water traffic in the future.

A. Development and Problems of Water Transport

7.4 Broadly speaking, China's navigable rivers fall into three distinct
basins: the Heilongjiang (Amur River) system in the northeast, the Changjiang
(Yangtze River) system in central and east China, and the Zhujiang (Pearl
River) system in the south. The Huanghe (Yellow River), which drains the
north China plain, is not on this list because it is plagued by heavy silting
that limits its navigational use. The Heilongjiang and its tributaries are
frozen for several months each winter, but the Changjiang and Zhujiang systems
are navigable and carry significant traffic throughout the year. The 1,747-
kilometer Grand Canal, completed in 1293, still provides an important north-
south corridor between Hangzhou and Beijing.

7.5 As of 1988, the network of navigable inland waterways totaled
109,400 kilometers. Of these, however, only 20,000 kilometers are regularly
maintained to a depth of one meter or more year-round, and fewer than 5,000
kilometers can accommodate vessels of over 1,000 tons. Although water trans-
port is potentially very important in China, it accounted for only 9.1 percent
of the tons of cargo shipped per kilometer and 3.3 percent of the passengers
carried per kilometer in 1988. The average density of traffic on the water-
ways was quite low: 0.99 million ton-kilometers and 0.02 million passenger-
kilometers, respectively. These figures highlight a unique situation--the use
of a vast network of small rivers to carry traffic that in most other coun-
tries would move by truck and bus, and the underuse of major waterways for
long-distance transport of bulk commodities.

7.6 In tonnage terms, waterway traffic, which amounted to 893 million
tons in 1988, is heavily concentrated on four key routes: the Changjiang
system (53 percent of tons carried), coastal shipping (20 percent), the Grand
Canal (14 percent), and the Zhujiang system (13 percent). Traffic densities
on these routes are much heavier than national averages and can be estimated
as follows:
Compared to other major waterways of the world, these traffic densities are low. The Rhine, for example, has a density of about 29 million ton-kilometers per kilometer, the St. Lawrence Seaway about 54 million, and the lower Mississippi about 76 million.

### Investment Levels

7.7 For many years official transportation policy emphasized railways. Waterways had a relatively low priority despite the fact that water transport can often be the cheapest mode for large bulk movements of coal and ore. Between 1949 and 1979, the sums spent on inland waterways made up only 1 percent of total national investment. The amount spent on China's most important river, the Changjiang, was only one-fourth of the total allocated for the single rail line between Chongqing and Xiangyang. Rail transport received between half and two-thirds of all investment in transportation and most of the materials required for construction and operation were available at favorable prices. This resulted in comparatively lower rail operating costs and attracted industries to locate along rail lines rather than waterways.

7.8 Rail dependence is found in the Soviet Union because waterways cannot be used year-round. In the United States and Europe, however, much heavy industry is located on waterways—and in Japan, along the coast—in order to take advantage of low-cost water transport. Such transport accounts for more than 30 percent of total ton-kilometers in the United States, more than 50 percent in the Netherlands, 20 percent in the German Federal Republic, and 50 percent plus in Japan. The figure for China is 17 percent.

7.9 Critics of China's earlier policies on water transport have identified a number of longstanding problems, including:

(a) The obstruction of navigation by dams built for hydroelectric and flood control purposes. According to recent statistics there are about 1,300 dams on the navigable rivers, and many hamper navigation. The lack of coordination evident when dams are built across navigable waterways is only the most visible aspect of a second, broader problem.

(b) Administrative conflict and weakness. According to one well-informed Chinese expert: "For one and the same river, flood prevention and power generation are administered by the Ministry of Water Resources and Electric Power, shipping affairs by the Ministry of Communications, aquatic production by the Ministry of Agriculture, Animal Husbandry, and Fisheries, and water-pollution control by the Ministry of Construction and Environmental Protection. The Travel and Tourism Bureau administers water-related scenic spots, while adjacent provinces, municipalities, prefectures, and counties also have their hands in administration." Quite apart from the problem
of obstructed navigation, inefficient operating practices have, for example, meant that wharves belonging to a particular ministry or unit could not be used by boats belonging to other units. As a result, many voyages were prolonged unnecessarily by the requirement to stop and report to the authorities of each involved jurisdiction.

(c) Inadequate investment for water transportation. Compared to levels in other developing countries, annual investment in the transportation sector has been low, measured as a percentage of overall investment or of gross national product. And as noted, railways have always received the largest share.

(d) Distorted prices affect water transport on the output and input sides. Tariffs for water transport compared to rail tariffs sometimes cause inappropriate shipping decisions. For example, the water and rail distances between Chongqing and Wuhan are virtually identical, but the freight rates by water are about 50 percent higher, even though the operating costs by water are almost certainly lower. The inevitable result is that traffic that should—and with different pricing would—move by water goes instead by rail.1/ On the input side, a key difference between water and rail transportation is that the former uses mainly petroleum for fuel, while the latter uses mainly coal. Thus, any distortion in the relative price of these two fuels gives one mode or the other an effective subsidy—which, at the moment, seems to favor the railways. Furthermore, fuel for the railways is provided entirely "within the plan," while some of the fuel used by water shipping must be purchased "outside the plan" at much higher prices.

Waterborne Traffic

7.10 In recent years the Guangzhou's traffic has been growing much faster than the Shanghai's, reflecting South China's increasing dependence on energy sources in the north and northeast. Oil and coal account for two-thirds of the Guangzhou's tonnage. On the inland waterways, the dominance of the Changjiang basin in current traffic patterns is overwhelming, although the Zhujiang and Grand Canal systems also carry significant traffic.

7.11 The traffic figures discussed so far are those of the state and collective shipping companies. But there is a significant amount of traffic by small private vessels and some larger-scale private shipping. Private vessels are generally much smaller than those of the state and collective fleets. (In Jiangsu province, the average private boat is about 12 tons, while the average state vessel is 50 tons.) Nevertheless, private vessels carry significant tonnages for short distances.

7.12 Technological development of water transport has lagged. Water transport costs are therefore only marginally lower than rail costs, and cus-

tomers have little incentive to use the slower mode. In contrast, water transport costs range between 10 and 30 percent in the United States. In India, the operating costs of a 1,500-ton vessel are about 40 percent of rail costs.

B. Inland Waterways

7.13 China's inland waterway system suffers by comparison with other developed systems. The network is similar to the that of Soviet Union in 1930, before massive new construction programs. Though further development of China's water transport is much needed, a number of ongoing projects appear well selected and should provide significant benefits when completed. They include the following:

* In the Zhujiang basin, major improvements will soon permit access by 1,000-ton vessels, encouraging development of mineral resources in the southwest.

* The Grand Canal runs from Beijing in the north to Hangzhou in the south. Extensive modernization of the 404 kilometers between Xuzhou and Yangzhou is nearing completion and will accommodate 2,000-ton vessels. This will significantly ease shipments of northern coal to industries in Shanghai.

* In the section of the canal south of the Changjiang, limited improvements have been undertaken but these will permit use by vessels only under 100 tons. Modernization could ease congestion by permitting 500-ton vessels on this reach and on connecting canals to Shanghai and the new port at Zhangjiang.

* The lower Changjiang has attractive navigational conditions. Ocean-going vessels of 10,000 deadweight tons can sail to Nanjing, and ships of 5,000 deadweight tons to Wuhan. Since 1950, channel depth has been improved from 2.3 meters to 4.0 meters, and the economic feasibility of increased dredging is doubtful.

* The middle Changjiang is more restricted, with a meandering and unstable channel. Extensive dredging and other works have increased depth, though a desirable depth is unavailable year-round. Further improvements of the channel on this reach would aid navigation but can probably only be achieved by an expensive river training program. Substantial improvement could also result from the construction of multipurpose dams (particularly the proposed Three Gorges hydropower station) in the upper reaches of the Changjiang. In such dam projects, however, there is a potential conflict between the desire to generate most hydropower during peak demand hours and the need to provide steady water flow for navigation.

* The upper Changjiang is a difficult passage. Conditions have been improved significantly by rock blasting and by excavating numerous rapids over the past 25 years, as well as by the construction of the Gezhouba Dam. The Three Gorges project, if built, will radically upgrade navigation on this reach. But the dam will pose two problems for shipping. Without an expensive shiplift, navigation will
be blocked during annual high-water flow during the 10 years of construction. The elevation of the reservoir will leave Chongqing port in the area of greatest sediment deposit. Available alternative plans includes low-water augmentation by additional dams built upstream or a change of location for the port.

Multipurpose Developments

7.14 In Western Europe, the United States and the USSR, modernization has been based on the multipurpose use of water resources. Projects depend on physical and economic conditions and, more specifically, on the primary purpose of the development. There are three common schemes of river-basin development that also improve navigation: construction of low-lift navigation locks and dams, water-flow regulation, and construction of large reservoirs for hydropower generation.

7.15 In the first scheme, navigation is the major component with additional benefits created for flood control, irrigation, and water supply. Hydropower is usually not included or plays a secondary role. The major advantages are the relatively low cost of the structures and little, if any, requirement of flooded land.

7.16 In the second scheme—water-flow regulation—reservoirs are built in the upper segments of a basin and/or tributaries to a main waterway. Often these reservoirs are located in non-navigable reaches and therefore do not include navigation structures. The prime purpose of such reservoirs is usually flood control, with additional benefits for hydropower generation and water supply. Navigation is improved downstream by flow augmentation during the low-flow period and by reduced sedimentation during the high-flow period.

7.17 In the third scheme—construction of large reservoirs—hydropower is the main purpose and navigation is drastically affected. Large reservoirs created under such a scheme provide almost unlimited channel dimensions in the upper pools and improve navigational conditions in the lower pools. Often, an uninterrupted cascade of reservoirs totally changes the entire waterway. This scheme requires expensive navigation locks. And the operating fleet must sometimes be replaced because of the wave action on large, lakelike reservoirs.

7.18 American river development includes examples of all three schemes. There are low-lift navigation locks and dams on the upper Mississippi River (663 miles), the Illinois waterway (354 miles), and the Ohio River (981 miles). A typical example of water-flow regulation is the Missouri Basin, with more than 80 reservoirs for hydropower generation, flood protection, and irrigation. Under the reservoir development scheme, the Columbia and Tennessee waterways provide hydropower generation, navigation, and flood control.

7.19 China’s water resources development has often brought benefits to navigation. The northern segment of the Grand Canal was modernized for multipurpose use with navigation as a leading component. The Gezhouba Dam, with hydropower as a leading component, greatly improved a reach of about 100 kilometers along the part of the Upper Changjiang most difficult to navigate. Large irrigation canals provide navigation. And as described above, water
regulation in the Upper Changjiang is a key to radical navigation improvements of the entire Changjiang waterway.

7.20 But there are examples of navigational damage as well. It is usually argued that serious damage has been inflicted on the waterway network by constructing relatively small dams since 1961. About 1,300 such dams, mostly for irrigation and water supply, have been built on navigable rivers. Because of budget limitations or economic priorities, many dams lack navigation locks, making waterways completely unusable for transportation. Despite recent government efforts to reestablish transit navigation on these waterways, about 60,000 kilometers are still closed. Reopening all or even part of this network would require substantial funds. Up to 500 navigation structures may be needed, most of them low-cost locks, but some more sophisticated facilities. Any decision to retrofit navigation facilities should be based on the results of a feasibility study rather than on a policy to maximize navigable length.

7.21 Cost is a key factor in determining whether waterway improvements are economically justified. But other issues must also be addressed. These include the availability of well-designed low-cost navigation structures (locks and shiplifts), the degree of coordination between provincial navigation bureaus and the central government, the integration of waterways as part of a regional transportation system, and the planning of waterways development as a component of multipurpose use of waterways.

7.22 Cooperation between central and provincial navigation bureaus is obviously a necessity, since all these organizations are direct users of water resources. Their cooperation is even more essential, however, because serious problems exist in definitions and in divisions of authority, responsibility, and budgetary commitments. Present Chinese practice applies a variety of qualitative conventions and rules. For example, a "bigger dam" is the responsibility of the central government, while a "smaller dam" is the responsibility of the province. Whoever built the original dam is responsible for its modification. The leading component in a multipurpose project provides the budget commitment for the entire project. Whoever builds the multipurpose project operates it—and so on. None of these rules eliminates confusion, unjustified demands, or interagency disputes.

7.23 A comprehensive plan of waterways development should identify waterways with good potential for transport. Traffic forecasts should estimate the level of investment that can be justified from a transport point of view. In cases where a waterway is primarily useful for irrigation, hydropower, or other purposes, appropriate agencies should do the primary planning. But they should consult the Ministry of Communications and the provincial transport bureaus at an early stage to ensure that transport potential is considered.

7.24 On China's vast network of minor waterways, some improvements are feasible. Work on all or even part of this large network would require a sizable financial commitment, largely to provide access to mines and factories. In general, however, the future of such waterways depends on policy for multipurpose use of water resources. The costs of hydropower, flood control, water supply, irrigation, and other works will often far exceed investments in water transportation. Navigation can be a beneficiary if it is included as a component of multipurpose water resource development.
Managing the Inland Waterways

7.25 The financing of China's waterways is shifting from government to user charges and bank loans. In the United States, user charges (a fuel tax) yield about $40 million each year--less than 6 percent of the total inland waterway budget. Most other countries impose no user charges at all. China is moving towards user charges, pegged at a level sufficient to cover nearly all maintenance and operating costs of the waterways. For larger shipping companies, the fees are levied as a percentage (3-7) of the enterprise's gross revenues. Individual barge or vessel owners generally pay a fixed annual amount per ton or per horsepower. In a few cases a charge is also imposed for lockage at recently built locks.

7.26 Bank loans are available to fund capital construction. But in practice, planners use them only reluctantly because they carry high interest rates. Among the other sources of capital funding that may be available in particular circumstances are cooperative ventures with factories or local governments and funds allocated for multipurpose water projects by central or local authorities.

7.27 Ports rely heavily on user charges. In the 25 main ports along the Changjiang, for example, there is a uniform fee of ¥0.25 per ton of cargo. This yields annual revenues of about ¥39 million. The revenues are not sufficient to cover costs. Since all ports collect the same fee while actual costs differ, some localities require larger subsidies than others. Despite the adverse consequences of this uniform tariff, there are no immediate plans to vary the fee in different ports. By contrast, the charges for warehousing, stevedoring, and so on do vary by port and cargo type.

Inland Ports

7.28 There are more than 1,000 inland ports in China. Only 400 handle more than 100,000 tons of cargo annually. The level of investment in inland ports has been relatively low. Typically these facilities are underequipped, their throughput is low, and their operating costs are high because they still use manual labor. The backwardness of loading/unloading technology is a major cause of port congestion. Many ports handle bulk shipments in sacks and bags. Pallets move cargoes within the ports but are seldom loaded aboard ship. As a consequence, vessels waste time in port.

7.29 The majority of storage and stockpile yards are inadequate. Except for industrial use, the consolidation of port systems has not yet begun. This often results in inadequate links with other modes of transport, especially trucking. In designing wharves, planners emphasize the advantages to the port itself and neglect the interests of other modes and cargo owners.

7.30 The opening of Nanjing to foreign vessels should increase the volume of general cargo handled. Along with nearby Nantong and Zhangjiagang, Nanjing may also serve as an economic alternative for some of the traffic now flowing through congested Shanghai. To handle the probable traffic increases, Nanjing will need substantial investments beyond the ¥360 million budgeted in the Seventh Five-Year Plan (1986-90). The Eighth Five-Year Plan tentatively includes ¥800 million for additional port facilities at Nanjing, concentrated
in a new area about 35 kilometers from the city and close to the largest railroad marshalling yard in East China.

The Inland Fleet

7.31 The total capacity of the inland fleet is 7.6 million tons. On the Changjiang system alone there are more than 800 shipping companies. The largest by far is the Changjiang Shipping Company (CSC), a unit of the Ministry of Communications, which operates more than 2,200 freight vessels and 130 passenger ships totaling 2.2 million deadweight tons. The provincial fleets that compete with CSC are generally free to operate throughout the country. In addition to state-run companies, there are shipping collectives, large factory shippers, and private owners.

7.32 CSC’s operating cost is 0.76 fen per ton-kilometer. Tariffs on the lower Changjiang, set by the state, are 0.84 fen per ton-kilometer for long-haul, low-value shipments (the bulk of CSC’s traffic). Tariffs cover operating costs but leave little margin for investments in fleet modernization or capacity increases. CSC once received its capital as a grant from the state. Since 1984, the firm has had to finance new purchases from its own resources or by bank loans. Increased tariffs are needed to put the company on a sound financial basis. Such increases will tend to divert more traffic to the railways, however, unless rail tariffs are also adjusted.

7.33 Few vessels move between China’s inland and coastal waterways. This causes a substantial amount of otherwise unnecessary transshipment, often in congested ports. The problem could be alleviated through (i) the introduction of seagoing barges or shallow-draft vessels capable of navigating on both rivers and oceans, and (ii) the further development of direct ship-to-ship transfer of cargoes in mid-channel. "Roll-on/roll-off" service on selected coastal and river routes would also aid shippers. Dalian, Tianjin, Shanghai, Wuhan, and Guangzhou are possible sites.

C. Conclusion

7.34 Until recently waterway development had a relatively low priority in China and the level of investment was substantially less than in other modes of transport. Reforms that allocate traffic through the market, permit private shipping companies to operate, and shift financing from government subsidies to bank loans will have a significant impact on water transport.

7.35 These will have to be supplemented by policies to rationalize cross-modal tariffs, increase the investment in waterborne transport facilities and to strike an efficient balance between the various uses of China’s water resources.
VIII. COAL PRICING IN CHINA

Introduction

8.1 Since 1989, China is the world's largest coal producer; coal supplies three-quarters of Chinese commercial energy. The country has a dual coal market. Roughly 60 percent of coal is under state allocation with prices regulated by the government at various levels. Since almost every economic sector uses coal directly or indirectly, its price has a wide impact on investment and consumption decisions. China's regulated coal prices are unrealistically low. These reduce incentives to use energy efficiently and lead to wasteful consumption. They have also created a need for large operating subsidies that drain the national budget. Government coal mines, which produce about half of total output, almost always operate at a loss.

8.2 A notion of the underpricing of coal can be derived from the 1987 FOB price of Chinese export-grade coal and that of Australian coal (Table 8.1; Australia is the major supplier to Pacific rim markets. Even though international coal prices were at their lowest level in over two decades, China would have been competitive if it had raised the price of steam coal 150 percent and coking coal 75 to 100 percent.

Table 8.1: PRICES OF CHINESE AND INTERNATIONAL COAL, 1987

<table>
<thead>
<tr>
<th></th>
<th>Datong Steam Coal</th>
<th>Kailuan Coking Coal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minemouth domestic price (Y/t) /a</td>
<td>35.8</td>
<td>73.0</td>
</tr>
<tr>
<td>Rail freight and ship loading charges (Y/t)</td>
<td>17.7</td>
<td>17.0</td>
</tr>
<tr>
<td>Total FOB coal price: (Y/t) /b</td>
<td>53.5</td>
<td>90.0</td>
</tr>
<tr>
<td>Australian FOB prices adjusted to Chinese coal quality (US$/t) /c</td>
<td>14.4</td>
<td>24.2</td>
</tr>
<tr>
<td></td>
<td>29.0</td>
<td>39.0-44.0</td>
</tr>
</tbody>
</table>

/a Based on China's 1985 "Coal Quality Standards and Ex-Factory Price."
/b Y 3.72 = $1.00.

8.3 Furthermore, under China's current coal-pricing structure, the price of a given coal does not reflect transportation costs or the balance between supply and demand. Currently, the regional minehead coal price differentials are so small that a given type of coal may be assigned multiple prices in the same market, depending on its origin. Quality-related price differentials also are low, with the result that higher-quality coals are underpriced. Distortions in the allocation and use of coal also are introduced by a series of ad hoc subsidies to producers, varying price levels for centrally controlled
and local mines, and classification within plan targets (basic production quota or above-quota output).

8.4 Many Chinese consumers resort to the free market to supplement their allocated coal supply at prices that are considerably higher than regulated ones. Official data on the total volume traded on the free market are not available, but it hovers near 40 percent; in specific cities or provinces, it is higher.\textsuperscript{1/} It is worth emphasizing that definitions of market coal vary. Cheap "market" coal may in some cases come from local mines outside the central allocation system but, nevertheless, may be subject to local controls by provincial price boards.

8.5 As part of the country's modernization, the Chinese coal industry needs increased investment, including funds for better coal transport. Of key importance also will be a quick adjustment in regulated coal prices and an accelerated pace of market deregulation. The completion of coal price reform, started in 1985 with the introduction of multiple-tier pricing, should be a priority in the 1990s. The objective of this paper is twofold: (i) to identify the main issues of the current coal pricing policies in China and (ii) to outline a course of action for coal price reform in the medium run.

A. Overview of the Coal Sector

8.6 As the backbone of China's energy sector, coal accounted for 73 percent of commercial energy consumed in 1989. There are more than 80,000 mines. The largest ones (about 600) come under the direction of the General Coal Corporation (GCC), which in turn falls under the Ministry of Energy. In 1989, these GCC mines contributed 46 percent of total output. They are technically advanced and focus on long-term planning, adequate recovery of coal reserves, provision of adequate social facilities, and mine safety. In addition, China lists 2,000 medium-sized mines owned and administered by provincial governments and 60,000 small mines financed and operated by local governments, cooperatives, or individuals. Production from locally administered mines grew 11.2 percent in 1989, compared to 3.4 percent for larger government-administered mines. Engineering and safety standards at the smaller mines are generally below those of the larger mines—a result of poor technology and operating procedures.

8.7 Smaller mines have more flexibility in marketing their output, however. This allows them to play an important role in setting coal prices, particularly in nearby markets. Only a proportion of local mine production comes

\textsuperscript{1/} Evidence of the extent of the free market comes from major buyers in East China. In Jiangsu province, 58 million tons were purchased by the Jiangsu Coal Company in 1988 to supply provincial and county enterprises and households (but not large state enterprises which received coal separately through the state allocation plan). Only 52 percent of its purchases came from the state allocation system. Of the coal purchased outside the state plan, 10 million tons came from within Jiangsu and 13 million tons came from Shanxi. In Shanghai, estimates are that 40-60 percent of the total coal supply is organized through the allocation system (40 percent in winter; 60 percent in summer). Many smaller state-owned enterprises (county) rely on market coal.
under GCC control for distribution at fixed prices to state-controlled industries. Local mines must also sell fixed amounts to local industries at below-market prices. A premium is added in some provinces to provide an incentive to producers and to mobilize funds for local mine development. Mines can sell at market prices any production above quota levels.

8.8 Production costs are low by international standards, averaging Y 34.3 a ton in 1986 at GCC mines and less at local mines. Average production costs increased 5.2 percent a year from 1978 to 1986. This hike reflects, in part, the introduction of depreciation, interest, and other charges to account for the cost of capital. Wages and welfare payments are the largest single cost category, making 30 percent of the total in 1986. Despite increasing mechanization, productivity in the GCC-controlled mines has been stagnant. At the same time, annual wage and welfare outlays per worker have risen by 2.3 percent per year in real terms. Future production costs in these mines will depend on whether productivity per worker can be increased. With the implementation of widespread price reforms, real increases can be expected in prices of materials, electricity, transportation, and depreciation charges—all of which feed into the costs of capital construction.

8.9 Local mine costs, however, can be 10 to 40 percent below GCC levels. This differential results from several factors. Local mines generally exploit shallower coal seams that require less investment in shafts and underground roadways. These mines have lower operating costs as a result of the lower ground pressures. They offer lower wages and benefits and operate at lower safety standards. Local mines do not emphasize high extraction rates as do GCC mines. Finally, local mines have been known to shift some of their operating costs (such as ventilation and water pumping needs) onto neighboring GCC mines.

8.10 Even when all of these factors are taken into account, there are still questions about what mining techniques are appropriate in China, given the relative costs of labor and capital and the operating efficiency of GCC mines. The practices of financing state mining investments with subsidized capital (only recently were nominal interest rates charged) and of ensuring full employment have led to overly capital-intensive mines, often without attendant savings in labor costs. Local mines provide a cost benchmark against which the performance of the larger centrally controlled mines must be judged.

8.11 The government has emphasized the development of smaller coal mines under provincial and local control to maintain output growth. It is aware that growth is not sustainable, however, because as these mines mature they will require increasing amounts of capital to work at deeper levels. There is also some concern that the proliferation of local mines has prevented full exploitation of large reserves that would have been amenable to mining by more capital-intensive, large-scale methods. The government has tried to balance the development of lower-cost coal resources in the north (mainly Shanxi), far from the main consumption centers, and those where mining conditions are more difficult but transport constraints less binding. Some GCC mines have introduced modern, mechanized techniques. Open-pit mining is quite new and represents only a small part of production.
8.12 In the last decade, there has been considerable experimentation with foreign financing for the industry, including bilateral funding by the Japan Eximbank, a joint venture with a US company, and a World Bank-financed project. But further foreign investment will depend to a large extent on China's ability to expand coal exports. The government target was to export 30 million tons in 1990; but exports in 1989 were only 15.3 million tons.

8.13 About 23 percent of all the coal produced and half of GCC-controlled coal goes to customers in other provinces. In 1987, 543 million tons of coal, or 60 percent of total production, went by railway, 6 percent by waterway, and a significant volume by highway (see Table 8.2). Shipping coal puts great pressure on transport: in 1987, 30 percent of rail and 15 percent of waterway traffics. Since the transportation network has not been able to cope with demand, the government is now investing large amounts in railways and ports. But transportation bottlenecks will persist for some years to come.

Table 8.2: COAL TRANSPORT BY RAIL AND WATERWAYS: 1987

<table>
<thead>
<tr>
<th></th>
<th>Rail</th>
<th>Waterways</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tonnage transported (mln tons)</td>
<td>543</td>
<td>60</td>
<td>603</td>
</tr>
<tr>
<td>Percent of total mode freight</td>
<td>40</td>
<td>27</td>
<td>38</td>
</tr>
<tr>
<td>Traffic volume (bln ton-km)</td>
<td>286</td>
<td>131</td>
<td>417</td>
</tr>
<tr>
<td>Percent of total mode volume</td>
<td>30</td>
<td>15</td>
<td>23</td>
</tr>
<tr>
<td>Average shipping distance (km)</td>
<td>526</td>
<td>2,192</td>
<td></td>
</tr>
<tr>
<td>Percent of mode average</td>
<td>79</td>
<td>57</td>
<td></td>
</tr>
</tbody>
</table>


8.14 Compared to other countries, China moves unusually large quantities of coal long distances by road. These arrangements are financially viable only because of the shortage of rail capacity and the resulting high margin between minemouth and delivered coal prices. The variety of vehicles found carrying coal attests to the shortage of appropriate transport capacity. Coal travels on everything from trailer trucks to two-wheel tractors and mule-drawn carts. The diversion of farming vehicles to the coal trade represents a profitable sideline for many farmers.

B. Existing Coal Pricing Policies

Regulated Prices

8.15 The price of coal in China depends on whether output comes under the government "plan" or is sold on the market. The GCC administers coal prices for the 88 Coal Mining Administrations (CMAs) under its control; the provincial authorities administer prices for provincial and county mines. The state plan allocates coal as well as the rail capacity that transports it. Some 25 percent of locally produced coal is also allocated under the plan; the rest
is marketed locally and to neighboring provinces. Local government allocates coal sold by local mines at a regulated price somewhere between a half and a third of the GCC price; sales to other areas command prices about twice as high but still below regulated prices. The shortage of transport capacity has meant that prices from local mines in coal-rich provinces have been kept low, but delivered prices in coal-short areas can exceed even international price levels.

8.16 The classification of coals is a GCC responsibility, and prices for each category are set by the National Price Bureau. Prices are determined with reference to standard raw and washed coals and adjusted for type (coking, steam, lignite), grade (washed, screened, raw, and by lump size), ash, moisture and sulfur content, and location of production. The current pricing method has several weaknesses. One is its orientation toward characteristics relevant mainly to coking coals. For example, ash content is considered rather than heating value, although the heat content of steam coal is the prime indicator of its value to the user. The classification and price index by coal type currently acts as another proxy for heat value. This can result in low-ash lignites being overpriced relative to thermal coal. These price indices are also designed to improve the financial viability of lignite mines. In practice, ash content is simpler to determine than heat value and requires less sophisticated equipment. Ash content can be used as an indicator of the heat value of steam coals, but only if curves relating the two parameters are developed for each deposit. Since 1985, officials have been experimenting with a pricing formula for steam coals based on heat value.

8.17 Another problem of the current pricing method is its exclusive use of multipliers to account for different locality or quality parameters. For example, a 20 percent premium may be applied to coal produced in Jiangsu compared to the same coal produced in Shanxi; the premium represents the transport cost advantage of local coal. Applied to a standard raw coal base price of Y 22.1 per ton, this is Y 4.4, while applied to a washed coal base price of Y 49.6 per ton, the 20 percent represents Y 9.9. The actual per-ton cost of coal transport from Shanxi to Jiangsu, however, is independent of the type and quality of coal; for example, it may be Y 13 per ton. Consequently, the local premium may either understate or overstate the cost of transport. At the same time, it distorts the relative values of raw and washed coal in Jiangsu.

8.18 Minehead prices for state-controlled mines rose 36 percent from 1978 to 1986. In addition, a Y 2 per ton surcharge to the consumer was added in 1983 because price increases had not been adequate to cover costs. Prices were adjusted upwards again in 1990. Transportation costs are not included in the minehead price. Under a six-year contract signed in 1985, GCC offered a multitiered price system to provide the mines with an incentive to overfulfill regional production targets. At the same time, regional and quality-related price differentials were increased to move prices closer to costs. Under the tiered pricing system, GCC charges a 50 percent premium for all production above the 1984 quota. A 100 percent premium is applied to all production exceeding an agreed annual quota that is shipped to end-users according to the state transportation plan. The mines can also sell excess coal not included in the transportation plan at negotiated prices. In practice, these negotiated prices have been at about the level of the 100 percent premium coal. The GCC has signed similar contracts with each mine under its control, specifying
its share of the contract targets. Production quotas are determined on a monthly basis.

8.19 **Individual and collective mines**, representing the bulk of local mine production (and 35 percent of total production), sell their coal in the free market as long as they can secure transport. Otherwise, they sell to the state mining bureaus. The competitive forces acting on such mines reflect local conditions and prices. In deficit regions, for example Jiangsu or Liaoning, mines are able to obtain high prices, while in surplus regions, notably Shanxi, their competitive position is weaker because of insufficient transport.

8.20 In the early and mid-1980s, areas with high production costs raised coal prices in order to stem financial losses. At the same time, price negotiation within certain defined limits was allowed. These reforms have led to low prices in coal-rich provinces and higher prices in areas that depend on deliveries of coal, since most rail transport capacity is allocated to centrally controlled and provincial mines. This shortage of rail transport leads to uneconomic long-distance shipments by road, and the transportation charges then form the bulk of the delivered price. As rail capacity increases in the long term, shipments by road should decrease, bringing down coal prices.

8.21 Comparing the prices of coal from the same field mined by state, local, and collective miners provides an example of the price differentials that exist for essentially the same quality coal (see Table 8.3).

8.22 The government has instituted several subsidies to encourage coal-producing provinces to supply coal to other regions. For instance, the provinces receive a government subsidy for GCC-produced coal shipped elsewhere: Y 2 a ton for raw coal and Y 4 for clean coal. The state also pays provincial governments a premium of Y 27 a ton for coal sold to other provinces as a substitute for oil. (Of this amount, Y 20 is to be invested in local mines.) Rail transport for this coal is centrally allocated. In the case of Shanxi, the fee was incorporated into the price of coal shipped out of the province. The result was that Hebei province, a major importer of Shanxi’s coal, cancelled its orders and sent trucks to purchase the coal directly in Shanxi. Negotiated prices for Shanxi coal have since declined because rail transport for this coal now appears too costly and a local oversupply of coal has appeared.

8.23 **Delivered Coal Prices.** Large enterprises receive coal directly from the mines according to a distribution plan; sales to other users are handled by coal distribution offices. Before 1979, distribution allocations were based on local government estimates of requirements. Wholesale and retail coal prices were set by the government; distributors received a subsidy to cover any losses. The retail price of coal for household use remained unchanged from 1965 to 1979. The delivered price of coal for nonsubsidized consumer groups was set to cover the minemouth coal price, transport charges, interest and management expenses, and the cost of coal losses in transit. Before 1984, distributors received subsidies on sales to farmers, vegetable farmers (for their domestic requirements only), restaurants, heating plants, and urban households. The subsidies to farms and industry have since been discontinued.
Table 8.3: MINEMOUTH COAL PRICES IN LUAN (SHANXI): 1981-86

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<tr>
<td><strong>Luan CMA (GCC)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yuan per ton</td>
<td>25.74</td>
<td>26.08</td>
<td>28.34</td>
<td>28.57</td>
<td>31.05</td>
<td>31.91</td>
</tr>
<tr>
<td>Percent GCC</td>
<td>54</td>
<td>49</td>
<td>49</td>
<td>45</td>
<td>44</td>
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<tr>
<td><strong>Qiyi Mine (local state-owned)</strong></td>
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<tr>
<td>Local market</td>
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<tr>
<td>Yuan per ton</td>
<td>14.00</td>
<td>-</td>
<td>14.00</td>
<td>14.00</td>
<td>14.00</td>
<td>14.00</td>
</tr>
<tr>
<td>Percent GCC</td>
<td>54</td>
<td>-</td>
<td>49</td>
<td>49</td>
<td>45</td>
<td>44</td>
</tr>
<tr>
<td>Other markets</td>
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<td></td>
<td></td>
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<tr>
<td>Yuan per ton</td>
<td>19.00</td>
<td>-</td>
<td>19.00</td>
<td>23.00</td>
<td>-</td>
<td>19.50</td>
</tr>
<tr>
<td>Percent GCC</td>
<td>74</td>
<td>-</td>
<td>67</td>
<td>81</td>
<td>-</td>
<td>61</td>
</tr>
<tr>
<td><strong>Xiadian Mine</strong></td>
<td></td>
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<td></td>
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<tr>
<td>(collective-owned)</td>
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<td>Local market</td>
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<td></td>
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<tr>
<td>Yuan per ton</td>
<td>8.00</td>
<td>-</td>
<td>8.00</td>
<td>10.00</td>
<td>10.00</td>
<td>10.00</td>
</tr>
<tr>
<td>Percent GCC</td>
<td>31</td>
<td>-</td>
<td>28</td>
<td>35</td>
<td>32</td>
<td>31</td>
</tr>
<tr>
<td>Other markets</td>
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<tr>
<td>Yuan per ton</td>
<td>8.00</td>
<td>-</td>
<td>14.00</td>
<td>20.00</td>
<td>-</td>
<td>14.30</td>
</tr>
<tr>
<td>Percent GCC</td>
<td>31</td>
<td>-</td>
<td>49</td>
<td>70</td>
<td>-</td>
<td>45</td>
</tr>
</tbody>
</table>

Note: Includes the Y 2 per ton fee, excludes "above quota" price bonuses. Coal transported by truck.

8.24 By 1980, coal-importing provinces began to take steps to secure adequate supplies. One is a form of barter trade termed "cooperation coal." This plan swaps coal for goods much in demand--watches, bicycles, steel products--and for rice at the state-regulated price. (The goods are sold at market prices.) Essentially, coal producers make up for a lack of internal cash generation through profits obtained from this trade. Another step involves the coal-short province providing a loan at no charge to a coal producer to develop production facilities in exchange for guaranteed coal supplies at the regulated price. The importing province then services its debt through sales of coal at a higher retail price.

Free-Market Prices

8.25 The relatively narrow free market absorbs supply and demand pressures throughout the economy. Prices can fluctuate sharply. In recent years, they have risen faster than inflation. Market prices in Shanghai and Jiangsu are at or exceed international levels. The trend in free-market prices for three mining areas is shown in Table 8.4.
Table 8.4: EVOLUTION OF COAL PRICES ON THE FREE MARKET \textsuperscript{a}
(Yuan/ton)

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>FOB Shanxi</td>
<td>50</td>
<td>80</td>
<td>100-120</td>
<td>110-140</td>
</tr>
<tr>
<td>FOB Xuzhou</td>
<td>90</td>
<td>100</td>
<td>180</td>
<td>220</td>
</tr>
<tr>
<td>FOB Shandong</td>
<td>-</td>
<td>-</td>
<td>100</td>
<td>200</td>
</tr>
</tbody>
</table>

\textsuperscript{a} These are indicative prices for steam coal. Shanxi is the main producing province in North China. Xuzhou is a mining area in the northern part of Jiangsu province, a major coal consumer in East China which also imports coal from North China. Shandong is a coastal province in North China and is both a producer and consumer.

8.26 The price differential between market and plan coal has widened in the late 1980s. In Nanjing, for example, the maximum price ratio between state and market coal prices was 2.2 in 1984. Reported price ratios in 1989 ranged up to a factor of four. In Shenyang, factors of three were more common. This widening of price differentials reflects the shortages of coal reported throughout China in 1988/89 as well as inflationary pressures not reflected in "plan" prices. Wide differentials in prices are not a problem per se. One would expect wide differentials in a coal market as large and diverse as China's. The problem with the present pricing system is that the differences come not from economic or quality variations but from arbitrary factors—whether the coal is sold on the allocated or free market and so on.

8.27 Prices in Shanxi rose from Y 50-60/ton in 1986 to Y 110-140/ton in early 1989, while minemouth prices from Xuzhou rose even more—from Y 90 to Y 220/ton. The large gap in market prices between Shanxi and provincial producers suggests that transport bottlenecks might be exaggerating price differentials. Introducing more capacity on the key routes from Shanxi would, in principle, bring down the marginal cost of transporting coal and allow Shanxi coal to compete against local production that, in many cases, is coming from higher-cost mines supplying lower-quality coal.

8.28 The range of delivered coal prices for steam coal (both plan and free-market prices) are shown in Table 8.5 for three major consuming areas and one major producing region, Shanxi. They again reflect locational differences.
Table 8.5: PLAN VS. FREE-MARKET PRICES FOR STEAM COAL, 1989

<table>
<thead>
<tr>
<th></th>
<th>Plan</th>
<th>Negotiated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beijing</td>
<td>55-70</td>
<td>140-150</td>
</tr>
<tr>
<td>Shenyang</td>
<td>45-70</td>
<td>80-180</td>
</tr>
<tr>
<td>Jiangsu</td>
<td>65-80</td>
<td>220-280</td>
</tr>
<tr>
<td>Shanxi</td>
<td>34-50</td>
<td>110-140</td>
</tr>
</tbody>
</table>

These represent indicative prices gathered during visits to the cities cited and discussions with coal-purchasing companies and users. Shenyang is located in a coal-producing area but one that cannot supply all needs. Beijing has limited production but is located only 500 kilometers from Datong, a major coal center in Shanxi. Jiangsu is a major coal-deficit province although some coal is produced in the north at Xuzhou and in neighboring provinces; coal delivered to the area from North China incurs high marginal transport costs.

Effects of the Dual Price System

8.29 The emergence of a dual pricing system for coal was perhaps a necessary transition to a more rational pricing system. The tiered price system has two theoretical advantages. First, at the margin, consumers pay a price that is closer to the true economic value of coal, introducing economic efficiency in the use of the resource while avoiding the inflation impact associated with applying such a price to all production. Second, as production increases, the average price of coal increases. In practice, however, CMAs found that customers rejected the higher-priced "above-quota" coal; starting in 1986, the ministry averaged the premium for all the coal sold by CMAs, except for sales to households. In 1987, the system was changed again to add a regional differential to the average price premium.

8.30 A major deficiency is that the level of revenues and their rate of increase built into the tiered pricing system are rather modest. Direct and indirect subsidies are and will continue to be required to cover operating costs and finance investments. Multiple prices also allow for profits through reselling low-priced coal at market prices. This may result in greater economic efficiency, but the additional revenue does not accrue to the producer.

8.31 Five years after the introduction of the dual pricing system, a large amount of coal sales is still made under conditions that encourage inefficient and wasteful practices. As the gap between plan and market prices widens, some consumers make wasteful decisions on the assumption that their quota will be raised—or as leverage for having it raised. In addition, they tend to use whatever coal they can get under the plan allocation system, irrespective of whether the quality or sourcing makes economic sense.
Price controls operating for certain consumers serve to hurt the supply of coal to those consumers. A case in point is the household sector which has no or little access to the anthracite market, even though anthracite should be one of its choice fuels (since it is a smokeless). This is because other users, such as ammonia plants (and even power generation in Shanxi), buy anthracite at higher free-market prices, while traditional price controls apply in the household sector.

Finally, the rigidity of plan prices causes more volatile price adjustments in the free market--particularly in periods of shortage--because of the narrower base for adjustment. A broadening of the free market would reduce the amplitude of price fluctuations and that, in turn, would facilitate adjustments to changes in supply and demand, encouraging consumers and suppliers to be more responsive to those changes by adjusting their behavior.

D. Principles of a Coal Price Reform

Border pricing of all Chinese coal would not be appropriate. China is a fairly new entrant in the international coal market and the volume exported is small in terms of domestic production (2 percent) and world trade (3 percent). The long-run marginal costs (LRMC) of coal production are estimated to be somewhat below international coal price levels, which currently are low. Given China's limited market penetration and the tendency of coal importers to seek diversified sources of supply, China has the potential to expand exports once it overcomes transport constraints and quality problems. While China is expanding its market share, international prices should be determined by a balance between China's LRMC and the short-run marginal costs of the excess mining capacity in countries facing contraction in output as a result of Chinese inroads into the market.

The most efficient pricing strategy for China would be to regulate coal export volumes to maximize its producers' net benefit and to base domestic prices on LRMC: with exports already determined, the opportunity cost of increased domestic consumption is the LRMC rather than the border price. The exceptions should be confined to washed coal of export-quality grade and certain blending coking coal. Such coal should conform to border prices, since its opportunity cost is linked to the border price of exportable coking coal.

While moving towards more efficient coal prices, two features of the coal industry should be taken into account. One is the dual nature of the sector, as evidenced by differences in producer access to equipment, transportation, and finance and by the degree of price regulation. The large GCC mines have preferential access to inputs and transportation, but these mines must sell most of their product at low prices. Only at the margin are they allowed to market above-quota output at a price that reflects market value. By contrast, local mines operate without access to railways but supply a smaller fraction of output at regulated prices and usually average lower production costs. This means that, in coal-rich regions, prices are low, since shipping capacity to deliver coal out of the region is limited and costly. In coal-short industrial areas, market prices are higher than administered prices for the same reason. As a result, large centrally administered mines with controlled revenues often end up supplying distant consumers operating within the state plan. Smaller mines satisfy local demand at both controlled and market prices and also serve as marginal suppliers to some distant markets.
8.37 A second characteristic of the coal industry is the fragmentary nature of markets. With planned allocation, producers and users have little need to develop marketing channels that optimize the match between the characteristics of a given coal and the needs of potential users. The underdevelopment of transport facilities limits any matching and, combined with distortions in the relative prices of rail, barge, and road shipping, leads to uneconomic shipping and production decisions.

8.38 Given the large number of coal producers and users in China, supply and demand in regional markets should determine prices. Under this scenario, rail transport would be the only link in the coal supply chain subject to regulation. Tariffs would be regulated to ensure that the railways did not use their monopoly position to appropriate producer and consumer surpluses, but other transport modes could behave as monopolies where transport capacity is short.

8.39 Coal prices present regulatory authorities with other difficulties. These stem from the diversity of coals produced and the moderate reliability of techniques to assign economic values to quality characteristics such as ash, heat content sulfur, moisture, and volatile contents. Developing the data required to assess the economic costs of, say, an extra percentage point of ash in a coal of a given calorific value is a difficult task; results are not always conclusive. Within this context, LRMC pricing and other administered pricing methods have limitations. While they can guide overall coal price levels and provide insights for coal development plans, they do not allow for the finer definition of coal prices. To achieve this, market forces must come into play.

8.40 One approach with considerable attractions would involve a fairly rapid increase in plan prices (over two years) to about 80 percent of the LRMC of supply, along with gradual deregulation (over five years). Plan prices would be increased by about 100 percent (this represents a 75 percent increase in the average price which includes surcharges and negotiated-price coal). Surcharges for above-quota coal would be eliminated, and all coal from a given source would carry a uniform price. With a rising proportion of coal sold at levels close to market-clearing prices, government allocations would be phased out. Basic procedures for negotiating coal supply contracts would be developed. The basic raw coal price would be set, but producers and users could negotiate prices with respect to quality. This would help ensure that market forces affect pricing decisions.

E. Accompanying Reforms

8.41 Sectoral subsidies, profit remittances, and taxes would be renegotiated in line with improved sector financial performance. An important aspect here is the provincial/central government relationship. Provincial governments currently receive the 3 percent product tax on coal sales, while profits from centrally controlled mines belong to the central government. Depending on the provincial economic structure, increased coal prices could cut provincial tax revenues if provincial industry's net income falls. In such cases, provincial policy may be to keep coal prices artificially low. A redesigned tax system for the coal sector should aim at minimizing such distortions. Finally, the concessional terms of loans for coal development
should be phased out in line with coal price increases and rules permitting private-sector equity investments should be established.

8.42 The above-listed reforms would substantially reduce the number of mines operating at a loss. Even so, certain facilities would remain uneconomic—mainly those producing lower-quality coals and those operating in worse-than-average geological conditions. During the transitional period to 1995, uneconomic mines should be identified and proposals developed to restructure or close them. Measures could be developed to offset the adverse financial impact on major users: coal-fired thermal power stations; town-gas factories; lime, cement, and fertilizer plants; brick and tile factories, and iron-smelting plants. In most cases, the product price would have to be increased, but compensatory adjustments that reduce the potential impact of the coal price rise on energy efficiency and pollution abatement should be ruled out.

8.43 A degree of coal sector-specific enterprise reform would help ensure the success of the coal price reform. Coal mine administrators should be vested with full financial responsibility and decision-making authority in such areas as personnel, investments, and use of after-tax income. Management emphasis would shift from maximizing tonnage output to maximizing net income. Better productivity and utilization of the existing asset base in centrally controlled mines would result. Provided that safety practices and control of mining areas in the provincial and collective coal mines sector are improved, these various reforms would bring in closer correspondence the production costs of mechanized and unmechanized mines. In the long run, individual mines should be able to compete against each other without cross-subsidization.

8.44 Transport, its capacity allocation and expansion, and its pricing will play a pivotal role in the transition to a less regulated coal price structure. Wider coal markets will exist only to the extent that local producers and users face choices with respect to purchasers and suppliers. Studies of transportation pricing should establish cost-based tariffs for railroad and waterway transport of coal. Such tariffs would promote least-cost coal producer-user linkages and ensure rational delivered coal prices. A study of contracting procedures would examine how the railways and waterways would adjust to progressively lower levels of state involvement in coal transport capacity allocation. It would also gauge the effect of increased coal producer and user-determined transport requirements. The objective would be to implement recommendations from such a study in parallel with coal price reforms.

F. Impact of Price Reform

Coal Industry

8.45 The financial performance of the coal industry is very weak and should be an important focus of the next step to reform coal prices. With an average coal price of ¥31.8 a ton, and average production costs of ¥34.3 a ton, the industry's losses in 1986 averaged 18 percent of revenues; the return on net fixed assets was minus 6 percent. Net internal cash generation was about 10 percent of total investment expenditures. In light of the various input price subsidies that remain, a switch to full economic LRMC-based pricing at minehead (¥87/tce) would make coal prices higher than they need to be
to put the sector on a sound financial footing. An interim target set at 80 percent of the LRMC might be easier to achieve (the level obtained when only capital is shadow-priced), with a transition to the full LRMC as price reforms are extended to other sectors of the economy. An immediate switch from the 1986 plan price of Y 34.5/tce to the interim target (Y 68/tce) would raise coal sales revenues by 76 percent; it would reduce the number of CMAs operating at a loss from 80 to 8; the proportion of GCC coal produced at a loss would fall from 89 percent to 3 percent.

8.46 Forecasts of the consolidated financial performance of centrally controlled CMAs were made for a base case scenario assuming reforms over a two-year period. An alternative, slower price reform was analyzed, under which coal prices are raised over a five-year period, 1989-93. In the base case scenario, the sector would show a rapid return to more normal levels of financial viability. Pretax net income would average 14 percent of revenue in 1990-95. The price increase would allow one-third of the total sectoral investment program in 1990-95 to be financed internally and would reduce debt financing of investments in new mining capacity from 100 percent to 60 percent by 1990.

8.47 Implementation of the slower price reform scenario would have a markedly negative impact on projected sector finances. Pretax net income would average only 2 percent in 1990-95. Internal financing of investment would average one-fifth of total investment, and all investment in new capacity would continue to be debt-financed. From a financial point of view, the slower price reform alternative is less desirable than the rapid introduction of higher coal prices.

**Industries and Households**

8.48 The suggested coal price increases would have a significant impact on the financial condition of several major industries: the greatest impact would be on thermal power and town-gas production with cost increases of 20 percent on average (town gas is based on coking coal). Electricity costs at the retail level would increase notably less (10 to 15 percent). Lime, cement, and iron smelting industries would incur cost increases of about 12 percent. Railroad freight and the pulp and paper industry show the lowest cost increases at 4 percent. Given that some coal is already supplied at higher above-quota prices, these estimates of the impact of regulated coal price changes represent upper limits.

8.49 Coal price increases would have only a minor impact on average household expenditures. The minemouth coal price increases proposed would translate into a 64 percent increase in the cost of delivered coal. Based on average urban household purchases of coal, the additional cost would amount to Y 6.5 per capita (or 0.7 percent of the 1986 average income of urban dwellers and at most 1.4 percent of that of rural residents).
IX. REFORMING POWER PRICES IN CHINA

9.1 China has made remarkable progress in developing its energy resources and particularly electric power supply, which grew at an average annual rate of 13.2 percent between 1949 and 1988. Power production is now the fourth largest in the world. Still, per capita consumption is among the world's lowest and severe power rationing causes industrial capacity to be underused. This limits China's economic growth.

9.2 A reform in electricity prices is central to the alleviation of power shortages. It would finance a sustained pace of power development and improve the efficiency of resources use.

9.3 The financial need for price reform is clear. In the late 1980s, energy supply investments absorbed close to 3 percent of the GDP. The power sector claimed more than 60 percent of that amount and a significant share of China's foreign exchange borrowings. After 1986, the government gradually moved to improve cost recovery; one important ruling authorizes a "new power, new price" policy guaranteeing that power prices will be sufficient to service the debt on newly commissioned projects. Because power loan maturities are relatively short, the "new power" price is typically 60 to 100 percent higher than the old one and the average price level is expected to rise sharply by the mid-1990s. However, before then, these revenue-enhancing measures will have increased little the inadequate self-financing capability of the power sector.

9.4 Power tariffs that reflect cost of supply by level of voltage, time of use, and load factor 1/ are not only perceived as fair by consumers and producers alike but have greatly enhanced demand-side and supply-side efficiency in many countries. Such tariffs could be extremely effective in China, where a very high share of electricity is consumed by large industries capable of changing their consumption patterns. An allocation of electricity on a reformed basis would be a great improvement over the existing quota system; it would encourage better use of fuel and investment resources.

9.5 The efficiency and fairness of the power tariff structure may have seemed unimportant to Chinese policymakers in the past. But in the 1990s, there will be increasing need for tariff restructuring. This paper focuses on East China, which has the largest interconnected power grid in the country and is representative of the predominantly coal-based power sector. After a brief overview of the power system and sector policies, the paper analyzes the long-run marginal cost (LRMC) of power supply and suggests a target tariff reflecting these costs for most power sales. It also assesses the impact of tariff changes on the prices of 200 commodities: electricity seldom accounts for more than 5 percent of the output value and the impact is small. Still, a transition period of a few years may be found technically necessary.

9.6 A major concern is the impact of coal price reform on power tariff reform. The target tariff would raise power prices by 50 percent on average, before any change in coal prices, but coal represents less than 35 percent of

1/ The load factor is the ratio between the average and maximum loads.
the suggested average target price. For grids like that of East China, where coal is priced within 25 percent of its cost, coal price reform will not add much to the new power price. In other cases, where steam coal is heavily subsidized, the cumulated impact of both reforms may be difficult to weather for some consumers and special transitional measures may be needed.

9.7 Another country-specific issue is whether and to what extent a multitier price system should be introduced for power as it was in the mid-1980s for other commodities. The purpose of this system was to introduce the market alongside the Five-Year Plan and let the two coexist for an interim period during which the market becomes predominant as a source of supply and pricing signals. In theory, this strategy has the advantage of enhancing efficiency (because decisions are made at the margin on the basis of market prices) while mitigating the price shock of the transition to the market. In practice, however, dual pricing has proven to be an open door to unfair treatment of consumers, rent seeking, and inefficiencies by the less dynamic consumers. In the case of electricity, another disadvantage is that it is so complicated as to preclude the introduction of truly effective improvements such as peak load tariffs.

9.8 Dual pricing may have been an inescapable detour on the road to efficient pricing for commodities with markets providing decentralized price signals that cannot be ignored. For natural monopolies like power supply no such markets exist; rather, output prices—whether "spot" or long-run—must be derived from the cost of supply by an integrated system and the transition to new prices is necessarily administered. Multitier pricing for power users has been tried and is still applied in a few cases in China; the dual pricing of coal and other commodities and the "new plant new price" policy created pressures for higher power price tiers applicable to incremental output. These tiers are often above the LRMC whereas protected consumers are typically charged a third of it. The blend of new and old power in the supply of consumers with political clout has become a topic for hard bargaining and a source of complications, inefficiencies, and ultimately revenue losses in the operations of the grid. In 1989, the government stopped recommending multitier pricing and started advocating a switch to the "new power" price by all plants, old as well as new.

A. Power Sector Overview

9.9 At the end of 1988, the total installed generating capacity of China was 115.5 billion kilowatts (kW), of which 28 percent was hydropower. Electricity generation that year amounted to 545 billion kilowatt-hours (kWh), 20 percent from hydropower. Energy sales by utilities reached 464 billion kWh. Industrial consumption made up 81 percent of this total, agriculture 7 percent, residential 6 percent, transport/communications 2 percent, and other services 4 percent. Residential use per capita was about 72 kWh in cities and 15 kWh in rural areas. Power is distributed through 30 grids, 11 of which exceed 1 billion kW and account for 85 percent of the total installed capacity. About 94 percent of townships and 85 percent of villages have access to electricity.

9.10 The Seventh Five-Year Plan (1986-90) envisaged increasing generating capacity by as much as 35,000 MW. Large thermal power stations were planned along the coast and near major coal mines. Hydroelectric development will
continue at the middle and upper reaches of the Yellow River, the Yangtze River, and the Hongshui River. The construction of two nuclear plants in Zhejiang and Guangdong provinces is almost completed.

9.11 By the year 2000, annual electricity requirements are expected to be in the range of 1,000-1,300 TWh. About 10,000 MW of additional generating capacity will have to be commissioned every year, amounting to an annual investment of about Y 20 billion. The share of electricity in commercial energy consumption is expected to increase from about 18 percent in 1980 to 27 percent in 2000, with manufacturing accounting for a major share. Electricity use per unit of value added will continue to fall, however. Use by the residential and commercial sectors is expected to grow 11 to 13 percent a year.

9.12 From 1982 to July 1988, the Ministry of Water Resources and Electric Power (MWREP), which employed 2.6 million people, was responsible for overseeing all aspects of electric power and water. The government reallocated these functions, putting water under the Ministry of Water Conservancy. The Ministry of Energy regulates electric power, fossil fuels, and nuclear energy. It shares with the State Energy Investment Corporation the responsibility for screening energy projects of national importance. The provinces have now more autonomy over locally funded projects. There are six regional power administrations, 22 provincial and municipal power bureaus operating as parts of the regional grids, and eight other power bureaus that still operate in isolation. In 1985, the government established the Huaneng International Power Development Corporation to tap foreign suppliers' and bilateral credits and to establish power plants, mainly in coastal areas.

East China Power System

9.13 The East China Electric Power Administration (ECEPA) is the regional authority for Jiangsu, Zhejiang, and Anhui provinces and the Shanghai municipality. This region accounted for 25 percent of the country's production and had a population of 180 million in 1988. ECEPA administers the state-owned power grid and is responsible for regional planning, accounting, and power dispatch. It manages generating units, construction, and research work through the provincial and municipal power bureaus. Power supply and customer service functions are carried out by lower echelon organizations in districts, towns, and counties.

9.14 The total installed capacity of the East China grid was 17.8 billion kW at the end of 1988, 87.2 percent thermal power and 13.8 percent hydro-power. Generation amounted to 90,107 billion kWh, of which network losses accounted for 8 percent. The central government owns most of the generating facilities; a few small plants (5 percent of total capacity) now belong to local governments. Provincial or municipal bureaus manage collective power plants owned by local governments or other investors. In the future, these plants will represent an increasing share of the additional capacity.

9.15 At present, the three voltage levels of 500, 220, and 110 kilovolts (kV) are used for power transmission. A large share of consumer supply at 35 kV and 10 kV is received from the tertiary windings of 220/110/35 kV and 110/35/10 kV transformers, respectively. There are four load dispatching centers. Shanghai, under the supervision of ECEPA, has overall responsibility
for the transfer of power between the three provinces and the municipality. The transmission and urban distribution lines belong to the ministry and are operated and maintained by ECEPA. The substations from 110 kV to 10 kV connecting consumers are owned, operated, and maintained by these consumers. In the districts and counties that are supplied in bulk, transmission and distribution lines as well as transformers belong to local governments.

9.16 Because of the severe shortage of electricity, ECEPA allocates power and energy strictly according to stipulated quotas. This is done in three ways. First, many requests for new connections or service extensions are simply not met. Second, an estimated 1,000 MW is shifted from peak daytime delivery to night hours: large noncontinuous energy-intensive activities such as nonferrous metal, heat processes, iron, and steel manufacturing are scheduled to operate at off-peak hours, as are single- or two-shift factories. Part of the energy demand by industry is curbed in the summer to meet demand for irrigation; for industrial customers, holidays are staggered to adjust their loads over a week, and rural consumers receive power in rotation. Finally, part of the power supply in overloaded areas is simply cut off. Such a blackout occurred in 1985, cutting 1,125 MW of power; it is estimated that power shortages reduced Shanghai's industrial output by about 20 percent that year.

9.17 As a result of rationing power and load-shedding (when the utility cuts off consumers), the system daily load curve is relatively flat and the daily load factor is fairly high, at 90 percent. Weekly and monthly load curves are also rather flat. The maximum demand on the system occurs in the summer.

9.18 Consumers on the grid are classified into seven categories: industry, commerce, rural, irrigation, bulk sales, residential, and others. Demand levels between 10 kV and 110 kV correspond mainly to industry; the demand at 380 V/220 V applies to agriculture. Energy is sold in bulk, mainly at the 35-kV and 10-kV levels, to the county bureaus. The bureaus in turn sell it to various rural industries and agricultural customers. Many of these consumers are scheduled to consume electricity during off-peak hours because of shortages. Since the bureau can control the consumption pattern of many customers, bulk sales exhibit a high load factor.

B. Pricing Arrangements

Bulk Purchase

9.19 ECEPA purchases electric power from two categories of suppliers. The first category is the Huaneng Corporation and locally owned power plants. Rates for power prices from these plants are based on generating costs, generation tax, and a stipulated amount covering the repayment of principal and interest on the plant's outstanding loans. This tariff is usually rather high. In principle, ECEPA is permitted to sell back this power on the basis of the purchase price plus investment and operating costs plus sales tax. The second category is manufacturers that generate their own power. The same method is used for prices on these power purchases. Plants financed by state funds have no loan or interest payments, however, so rates are lower. The ratio between the average revenue at the plant level and that at the final sales level is based on the distribution of fixed assets. It ranges from 3:7
to 4:6. Power exchanges among the three provinces of East China and the Shanghai municipality are arranged by ECEPA, based on cost plus a margin split 60 percent to the bulk supplier and 40 percent to the buyer.

**Sales Tariffs**

9.20 Electricity rates to final consumers in the East China grid vary according to the voltage provided. There are five tariff categories: lighting, agriculture, large industry, small industry and commerce, and bulk sales. There is a two-part tariff for large industry (Table 9.1). It involves a demand charge levied on the maximum load (in kW) that consumers impose on the generating and transmission equipment and an energy charge levied on the load accumulated over time (in kWh) and largely related to the variable running costs of the system.

**Table 9.1: ELECTRIC POWER TARIFFS, 1987**

<table>
<thead>
<tr>
<th>Maximum Demand Charge (Y/month)</th>
<th>Energy Charge (f/kWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Up to 1 kV</td>
</tr>
<tr>
<td><strong>Lighting /b</strong></td>
<td></td>
</tr>
<tr>
<td>Shanghai</td>
<td>-</td>
</tr>
<tr>
<td>Jiangsu</td>
<td>-</td>
</tr>
<tr>
<td>Anhui</td>
<td>-</td>
</tr>
<tr>
<td>Zhejiang</td>
<td>-</td>
</tr>
<tr>
<td><strong>Small Industry</strong></td>
<td></td>
</tr>
<tr>
<td>and Commerce</td>
<td>-</td>
</tr>
<tr>
<td><strong>Large Industry</strong></td>
<td>6/kW or</td>
</tr>
<tr>
<td>4/kVA*</td>
<td>-</td>
</tr>
<tr>
<td><strong>Agriculture /c</strong></td>
<td></td>
</tr>
<tr>
<td>Retail</td>
<td>-</td>
</tr>
</tbody>
</table>

* kilovolt ampere.

/a Rates include a sales tax of about 15 percent.
/b Lighting consumption by all categories of consumers is metered and billed separately at the lighting rate.
/c Includes activities related to agricultural production (for example, threshing) and not to rural industries or residential consumption.

9.21 Several county power supply bureaus are financially independent. These bureaus receive electricity in bulk from ECEPA and sell it to customers at retail prices. Seventy percent of retail sale revenue is remitted to ECEPA as the purchasing cost and the remaining 30 percent is retained by the county
bureaus. The average per unit bulk sale revenue remitted to ECEPA was f 5.8/kWh in 1986. This arrangement generates more revenue than the wholesale agricultural rate, which is now largely ignored.

9.22 In 1986, the State Council authorized a surcharge to be levied by provincial governments to finance plant construction. Since then, East China, a f 2/kWh surcharge exists for industries with profitable operations; it yielded Y 4.8 billion or f 0.8 per kWh of total sales in 1986.

Metering and Billing Arrangements

9.23 Customers at high or medium voltage levels are metered individually. Heavy users billed according to the two-part tariff usually have meters equipped for metering kilowatts and kilowatt hours. A customer pays Y 6 per kW for the amount of maximum load stipulated in his contract; he is charged twice that for the amount of his peak demand above that contractual level. For a number of users whose demand requirements are smaller, the demand charge is billed according to the capacity of their transformer. Some residential consumption is metered according to total energy use by the building, and the residents share the charge. Low voltage consumption within agricultural communities often is not metered.

9.24 Billing frequency may vary from one to three times a month, depending on customer size. Low voltage users are billed once a month based on actual consumption. Customers must pay their bills on time or they can be disconnected. All nonagricultural consumers are required to pay a charge for reconnection. Since these rules are strictly enforced, customers very seldom fall into arrears. Accounts receivable from power sales in Shanghai amounted to only 5 percent of sales.

Pricing Issues

9.25 The average price of electricity has changed little over the last 30 years, oscillating between a maximum of f 9/kWh in 1960 and a minimum of f 7/kWh in 1980. Nor have any remarkable changes occurred in the tariff structure. In 1985, ECEPA's average sales revenue reached f 7.7/kWh. The increase did not make up for a higher sales tax and rising commodity prices. Coal, for example, rose 30.2 percent in five years as a result of a continuing policy to bring the price up to its economic cost. ECEPA's financial position is projected to erode further as a result of additional increases in the price of all its major inputs.

9.26 Even though ECEPA has not introduced the multitier price system, the tariff structure is distorted: the surcharges, the ratio of demand to energy charges, and the existing tariff classification bear no relationship to the differences in service cost associated with load factor, coincidence with system peak, and the voltage level at which the load is connected. A State Council ruling dated May 1985 authorizes increases in power prices for new generating plants (see above, bulk purchase rates) and time-of-use tariff differentials. This ruling can be used as a starting point for a systematic electricity price reform that would meet four essential criteria: efficient resource allocation, fairness toward consumers, simplicity in metering and billing, and financial viability of the power sector.
Recommendations

9.27 Rates based on the long-run marginal cost of supply, which explicitly addresses the questions of efficiency and fair treatment to customers with comparable consumption patterns, have the greatest appeal. These tariffs are also kept simple and responsive to the needs of low-income customers. Finally, with small adjustments, these tariffs adequately meet the financial requirements of electricity production and distribution.

9.28 Because distortions in coal prices are likely to remain, a second-best solution is to allow the energy component of power prices remain correspondingly distorted, whereas the capacity component should reflect the economic cost. This solution uncouples the coal and power price reforms and maintains appropriate emphasis on the power capacity bottlenecks. Also, because so many captive uses of electricity have yet to be developed in China, this solution is unlikely to create incentives for uneconomical substitutions between power and coal.

C. Cost Analysis

Long-Run Marginal Capacity Costs

9.29 Many power plants commissioned after 1990 will be 600 MW coal-fired units, the investment cost of which, after shadow pricing, largely determines the marginal capacity cost of generation estimated at Y 343/kW per annum.2/ Given the low share of hydropower in the region, 100 percent of this cost is attributable to meeting the peak load—there is no need to firm up the energy supply under dry-year conditions.

9.30 The capacity cost of transmission is considered to be the average incremental cost (AIC) for the period 1986-96, that is, for various voltage levels, the discounted value of investments and O&M outlays, divided by the present value of the incremental demand discounted to 1986. AICs range from Y 57/kW per annum for 220 kV transmission to Y 186/kW per annum for 10 kV. The capacity cost of distribution is considered to be 50 to 60 percent of the distribution AIC after the exclusion of infrastructure costs, which will not increase with demand intensity (a very striking manifestation of increasing returns to scale).

Marginal Energy Costs

9.31 The system peak is met only partly by hydropower. About 70 to 75 percent of the peak load is borne by coal- and oil-fired plants, which therefore determines marginal energy costs. The fuel cost of a 125-MW unit can be taken as the system's marginal energy cost. The long-run economic cost of standard coal is Y 4.07/million Btu. After losses for plant use, the energy cost at the plant is f 4.4/kWh.

2/ At a 10 percent discount rate, the total annualized fixed costs amount to Y 400/kW net of station use and outages. With their large capacity and low heat rate, new 600-MW units will displace less efficient ones, so that 15 percent of their investment cost is offset by fuel savings.
9.32 The capacity costs and energy costs of generation, transmission, and distribution including losses at various voltage levels are summarized in Table 9.2.

<table>
<thead>
<tr>
<th>Voltage Level</th>
<th>Capacity cost (Y/kW/year)</th>
<th>Energy cost (f/kWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plant outlet</td>
<td>343 343 4.4</td>
<td></td>
</tr>
<tr>
<td>220 kV</td>
<td>353 57 410 4.5</td>
<td></td>
</tr>
<tr>
<td>110 kV</td>
<td>355 90 445 4.5</td>
<td></td>
</tr>
<tr>
<td>35 kV</td>
<td>359 130 489 4.6</td>
<td></td>
</tr>
<tr>
<td>10 kV</td>
<td>364 186 550 4.7</td>
<td></td>
</tr>
<tr>
<td>380 V rural</td>
<td>374 321 695 4.8</td>
<td></td>
</tr>
<tr>
<td>380 V urban</td>
<td>374 247 621 4.8</td>
<td></td>
</tr>
</tbody>
</table>

Cost of Service

9.33 A customer's contribution to the cost of expanding an element of the network depends on the degree of coincidence between his maximum hourly demand in kilowatts in relation to the maximum load of this element. This coincidence factor increases with the customer's daytime load factor because the more kilowatt hours are consumed per kW of customer's peak demand, the more likely it is that this consumption will be contributing to the system peak.

9.34 The cost of service can be derived from Table 9.2 as the sum of the energy cost augmented by a capacity component. Comparisons between the costs of service and revenues from existing pricing arrangements reveal important economic subsidies:

(a) Industries and commerce firms with high load factors enjoy subsidies that range from 25 percent at 110 kV to 35 percent at 380 V. When the load factor is lower, subsidies exceed 50 percent except for nighttime users.

(b) Rural agricultural users do not cover more than 50 percent of their costs, even when they avoid daytime consumption or exhibit a high load factor.

(c) Residential users cover about half their marginal cost--more in cities, less in rural areas.

9.35 By weighting the subsidies of each category by the share of the total consumption, one obtains the following distribution of the total amount of subsidies the categories receive from ECEPA:
110 and 35 kV HLF and off-peak industries 25 percent
10 kV and 380 V HLF industries and commerce 20 percent
10 kV ILF industries and commerce 30 percent
Low voltage rural 18 percent
Residential (rural and urban) 7 percent

D. Target Structure of Sales Tariffs

9.36 The structure of economic costs for power services over East China's interconnected grid is simple enough to be reflected in the power tariff structure with little adjustment. Economic costs do not vary from one season to the next. There are geographical differences as between rural and urban areas, but there is a strong presumption that a uniform regional tariff would not distort consumer choices. One priority in the design of a targeted optimum tariff is to reflect differences in cost between high, medium, and low voltages and between peak and off-peak periods, for power purchases and sales to the largest customers. Subsidies for residential customers need not be completely eliminated at this stage of development when consumption does not exceed basic needs and subsidized sales are so small that they are not a financial burden. The proposed rate schedule is shown in Table 9.3.

Table 9.3: TARGET RATE SCHEDULE
(1986 prices)

<table>
<thead>
<tr>
<th>Tariff options</th>
<th>Energy charge (fen/kWh)</th>
<th>Demand charge (Y/kW/year)</th>
<th>Connection fee (Y/kW)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Peak</td>
<td>Shoulder</td>
<td>Night</td>
</tr>
<tr>
<td>110 kV</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High LF</td>
<td>8.1</td>
<td>5.4</td>
<td>4.5</td>
</tr>
<tr>
<td>Intermediate LF</td>
<td>15.4</td>
<td>7.2</td>
<td>4.5</td>
</tr>
<tr>
<td>Standby</td>
<td>19.0</td>
<td>8.0</td>
<td>4.5</td>
</tr>
<tr>
<td>35 kV</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High LF</td>
<td>8.6</td>
<td>5.5</td>
<td>4.6</td>
</tr>
<tr>
<td>Intermediate LF</td>
<td>16.5</td>
<td>7.3</td>
<td>4.6</td>
</tr>
<tr>
<td>Standby</td>
<td>20.4</td>
<td>8.2</td>
<td>4.6</td>
</tr>
<tr>
<td>10 kV</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High LF</td>
<td>6.0</td>
<td>6.0</td>
<td>6.0</td>
</tr>
<tr>
<td>Intermediate LF</td>
<td>9.8</td>
<td>9.8</td>
<td>9.8</td>
</tr>
<tr>
<td>(time-of-day options also available to large consumers)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>380/220 V Standard</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Night use</td>
<td>18.0</td>
<td>18.0</td>
<td>18.0</td>
</tr>
</tbody>
</table>

9.37 No increasing or decreasing block tariffs are proposed to either encourage or curtail specific uses of electricity. Quotas and rationing are expected to be phased out gradually. In the meantime, no price discrimination is recommended for consumption levels that are above or below a specified quota. Such discrimination would perpetuate the use of quotas even after their usefulness as a rationing tool has disappeared. It would also perpetu-
ate—and amplify as consumption grows—the distorting impact of current practices on consumer income and on the efficiency of energy use.

9.38 Peak capacity costs in East China are relatively high at the generating plant level. It is appropriate to reflect this high cost in the rates. Two-part (kW and kWh) tariffs reflecting peak and off-peak cost differentials are proposed for customers at 110 kV, 35 kV, and 10 kV. This group represents 86 percent of energy sales and 12 percent of the customer population. However, at 10 kV, simplified tariff options are also proposed. Time-of-use options at low voltage are not feasible or warranted at this stage of market development.

9.39 Power peaks in the region occur twice daily, but because of rationing, they are not very pronounced now, but they will become increasingly so in the future. To be effective, the peak tariff period must be short (say, 8 to 10:30 a.m. and 6:30 to 9 p.m.) and the night period (11 p.m. to 6:30 a.m.) and buttressed by a "shoulder" period for large customers, which otherwise would cause shifts in the system peak load. Weekend loads are expected to remain very similar to those prevailing during the week.

9.40 For large customers, rolling part of the capacity cost into the energy charge and letting them choose the roll-in scheme best suited to their load factor has advantages that far outweigh the extra metering cost. These schemes are designed on the basis of the correlation between customers' peak coincidence factor and load factor, so that intermittent users can choose to pay a lower kilowatt charge (but a higher kilowatt-hour charge at peak). Tariffs would be proposed for the emergency supply of power over brief time periods (standby service). The capacity costs of the higher voltage network are allocated according to the time distribution of outage risk: 60 percent to peak hours and 40 percent to shoulder hours. Discounts are proposed on that basis for any demand contracted to occur exclusively at night.

9.41 Low voltage rates in urban and rural areas are averaged and set close to the level of today's lighting rate for residential users. Larger low-voltage customers would pay the full cost of supply. Distinctions no longer would be made between lighting and other household uses, eliminating the need for separate metering. Discounts for night use are advised insofar as they would be simple for the power bureau to administer.

E. Bulk Purchase Tariff Guidelines

9.42 The terms for large bulk purchases by ECEPA must be negotiated on a case-by-case basis within a framework consistent with the sales tariff. Purchase price ceilings are the system marginal costs, which represent the fixed and variable costs that ECEPA would incur to produce the amount of power it is purchasing. The capacity cost saving is Y 343 per kW of peak power guaranteed the year round but zero for spot power purchases. The fuel savings would exist in any case. Two-part (kW and kWh) purchase tariffs should be the rule to stimulate a high dependability of independent generation at peak.

F. Target Rate Level

9.43 The income from the proposed rate change could reach f 13.5/kWh at 1986 prices. The income earned by independent owners of large thermal plants
could approach f $8.4/kWh. These figures must be compared to the f $7.7/kWh received in 1986 by ECEPA plus the surcharge levied by provincial governments (f $0.8/kWh). The additional f $5/kWh revenue from sales would represent a 60 percent average increase before inflation, one-fifth due to raising the price of coal to its economic cost.

9.44 The rate of return on revalued assets for an investor-owned 600-MW coal-fired plant at the midpoint of a 20-year depreciation period appears in Table 9.4. This rate of return is robust even if, in the future, the plant financial price reaches its economic cost.

| Table 9.4: ACCOUNTING COSTS FOR A COAL-FIRED PLANT (f/kWh at 1986 prices) |
|------------------|------------------|
| Asset valuation | Financial price x 50 percent | Economic cost x 50 percent |
| Fuel            | 4.10             | 4.10                      |
| Operation and maintenance | 0.73             | 1.05                      |
| Depreciation (5 percent per annum) | 1.04             | 1.50                      |
| **Total**       | **5.87**         | **6.65**                  |
| Net income from target rate | 2.53             | 1.75                      |
| Value of assets | 10.4             | 15.0                      |
| Pretax rate of return on asset value | 24.4%            | 11.7%                     |

G. Base Scenario Projections

9.45 Financial forecasts have been prepared to assess the viability of the target rates. The changes in metering and billing required by the reform cannot be made in less than four years, and considering the gap between the suggested target rates and the current levels for some sensitive segments of the economy, a longer transition period may be desirable. The current low level of indebtedness of the power subsector does appear to make a long transition period feasible. The set of forecasts presented here corresponds to a seven-year reform. Inflation is projected at 7 percent a year until 1990 and at 4 percent a year thereafter. Two forecasts have been established: one corresponds to the current assumptions by the government, the other to normative assumptions.

9.46 The base scenario assumes that the power tariff reform would start in 1989 and be completed by 1995. Coal prices are frozen in real terms every year except in 1990, when they are increased by 22 percent to reach their economic level. The prices for energy purchases from large thermal plants are maintained at a constant ratio of the revenue per kilowatt-hour of retail sales (see Table 9.5).
Table 9.5: TRANSITIONAL PRICE LEVELS
(at 1986 prices)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Power sales (f/kWh)</td>
<td>8.50</td>
<td>9.50</td>
<td>10.50</td>
<td>11.50</td>
<td>12.20</td>
<td>12.90</td>
<td>13.20</td>
<td>13.50</td>
</tr>
<tr>
<td>Power purchases (f/kWh)</td>
<td>5.80</td>
<td>5.90</td>
<td>6.50</td>
<td>7.10</td>
<td>7.60</td>
<td>8.00</td>
<td>8.20</td>
<td>8.40</td>
</tr>
<tr>
<td>Steam coal (Y/million Btu)</td>
<td>3.17</td>
<td>3.17</td>
<td>4.07</td>
<td>4.07</td>
<td>4.07</td>
<td>4.07</td>
<td>4.07</td>
<td>4.07</td>
</tr>
</tbody>
</table>

9.47 Under current assumptions, ECEPA’s financial indicators slowly deteriorate as long as the tariff remains frozen in real terms at its present level. The rate of return after taxes is about 5 percent; the self-financing ratio after remittance to government declines from 27 percent to 18 percent; the debt/equity ratio increases from 27/70 to 53/47. In 1989, as the tariff reform begins, all these indicators improve. However, these indicators must be interpreted with caution. The assumptions are (i) that assets are not revalued even though inflation is projected to run high; (ii) taxation and variable rates of remittances follow very specific Chinese regulations; (iii) most of the debt is contracted at a low nominal interest rate of 3.6 percent a year; and (iv) local governments carry most of the burden of financing new generating plants after 1990.

9.48 With the normative assumptions, the reform scenario can be put to a better test of financial viability. First, all new loans feature a 20-year maturity and a nominal interest rate of 8 percent a year. Second, the cash requirements for all the new large plants are brought into the projections by assuming that ECEPA would finance, own, and operate these plants. The tariff reform props up the self-financing ratio to 30 percent in 1990 and 37 percent in 1995; the debt/equity ratio drops from 60/40 in 1990 to under 50/50 in 1995. In spite of the higher interest rate, the debt service coverage ratio is maintained above 1.5. The rate of return after taxes is about the same under either current or normative assumptions.

9.49 The target tariff, if reached by the year 1995, would guarantee a healthy cash flow to the power sector while aiming at a relatively low level of sector indebtedness. As power shortages are gradually eliminated, the sector growth rate will fall and heavy borrowing would then lose its clear-cut

3/ The tax on electricity generated is f 1/kWh and the tax on retail electricity sales is 10 percent of the revenue. The tax levied by local governments is 7 percent of the above taxes. Income tax is 55 percent of the operating income after interest charged to operations and loan principal repayment.

4/ If it is assumed that the remittance to the government is kept as cash generated by ECEPA, the self-financing ratio reaches 50 percent in 1994 and 1995.
financial cost advantage; it would have to be subordinated to other, broader objectives, such as the country's creditworthiness in foreign financial markets. The large size of the power investment program would make it unwise to rely excessively on borrowing. Finally, as China enjoys relatively low-cost power, keeping power price subsidies on a large scale does not present any discernible advantages; on the contrary, economic-cost pricing is needed to put the country's pattern of power consumption on a sound footing.

H. Implementation Strategy

Principles

9.50 Target revenues are more than 50 percent above existing levels for all categories, except for those heavy users that now pay a surcharge, rural demand at night, and residential customers. The reform must proceed in a way that ensures that consumer choices between rate options are not distorted during the transition and that the more painful adjustments for daytime rural users are made over a longer period of time.

9.51 While technical and socioeconomic constraints necessitate a gradual transition, there is merit in starting with enough momentum to implant the reform in the public consciousness. Information campaigns should clearly state the thrust and scope of the reform at this initial stage. Later, detailed explanations of the reform would reinforce the original commitment.

9.52 In addition to price changes, the proposed reform implies a new classification system for customers now grouped by occupation and use; it should, in the future, hinge on parameters that influence the cost of service.

9.53 With respect to revenue sharing between owners of power facilities, two important policy measures are recommended. First, surcharges levied by local government to finance power facilities should be eliminated since purchase tariffs would provide adequate incentives for potential investors at the outset. Second, the 70/30 split of revenue from retail sales between ECEPA and locally owned distribution entities should be gradually replaced by a buy-and-sell mechanism based on the new tariffs.

9.54 Triple time-of-day meters and clocked maximum demand recorders must be installed for the 110-kV and 35-kV consumers (2,300 in 1989). At 10 kV, there will be about 250,000 customers, 15 percent of them with a maximum demand in excess of 300 kW, who should adopt time-of-day tariffs. The large number of customers involved calls for a simplified tariff in the first three years for most 10-kV customers and the installation of time-of-day meters at the pace of about 12,000/year. For small consumers, the demand charge can be billed on the basis of fuse or circuit-breaker capacity or ownership of electric appliances.

9.55 Transition tariffs have been worked out following the above principles. According to the base reform scenario, in the third year, the reform would be practically completed for the 110-kV and 35-kV consumers; it would be completed for the residential and low voltage night uses. Only in the fifth year would the reform be completed for all other consumers. To meet this schedule, real increases in revenue need to be realized in the first year for the industrial and commercial and rural users with ILF options and the stan-
dard low voltage tariff. All the existing flat rate tariffs which must ultimately merge into two-part tariffs would acquire a demand charge in the first year. The nominal rates of increase peak in the first year at 50 percent for the 10-kV intermediate load factor option.

I. Impact of Reform on Commodity Prices

9.56 The impact of the power price reform on the prices of 200 commodities has been assessed with the help of a nationwide input-output matrix for 1981 after grouping the percentage rate increases before inflation into five classes (see Table 9.6).

Table 9.6: EFFECT OF PROJECTED POWER PRICE INCREASES ON REVENUE
OF ELECTRICITY PRODUCERS AND ON COMMODITY INPUT PRICES

<table>
<thead>
<tr>
<th></th>
<th>Revenue (f/kWh)</th>
<th>Increase in input price (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>High and Medium Voltage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High load factor options</td>
<td>9.0</td>
<td>10.5</td>
</tr>
<tr>
<td>Intermediate load factor options</td>
<td>11.6</td>
<td>14.2</td>
</tr>
<tr>
<td>Low Voltage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Small industry</td>
<td>11.4</td>
<td>19.8</td>
</tr>
<tr>
<td>Rural</td>
<td>10.0</td>
<td>19.8</td>
</tr>
<tr>
<td>Residential</td>
<td>21.1</td>
<td>21.1</td>
</tr>
</tbody>
</table>

9.57 Despite high power input price hikes, only 16 of the 200 resulting price increases in user industries would exceed 5 percent and only three--ceramics, aluminum, and caustic soda--would reach 10 to 15 percent. The impact of the price reform would be less if some of the power demand for energy-intensive products, rural uses, and bulk water supply is shifted to off-peak hours. The risks that the price reform would fuel general inflation are less related to its mechanical impact than to the anticipations of power users. While these anticipations should not influence the choice of the target tariff, they should be borne in mind and their impact balanced against the objectives of the reform when choosing a transition scenario. The small industrial and rural tariffs are cases in point. For them, a transition period of less than seven years would aggravate an already steep annual pace of tariff increases--but it would not entail appreciable financial improvements for ECEPA.
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