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4 Market Transition: Strategy and Process

Since China launched economic reforms at the end of 1978, market transition has extended over almost 30 years. Indeed, today China has already spent as long a period building a market economy as under Maoist socialism. China's economy has been transformed by successive waves of economic reform. Over the years the content of the reform process has adapted to new challenges and circumstances, and has been continuously reformulated. There have been failures and reverses on occasion, but what is most remarkable is simply how far China has come toward a market economy and how the reform process has maintained its relevance as the challenges the economy faces have changed. By at least the mid-1990s, China had successfully moved away from the command economy and adopted a functioning market economy. Nevertheless, even today, the process of market transition in China is far from complete. Many of the institutions necessary for a market economy are rudimentary, and further market building and institutionalization are necessary. The broad issues of transition extend into every aspect of the economy today. In this chapter, the focus is on the overall process of market transition. Subsequently, Chapters 5 through 20 focus on specific sectors or aspects of the contemporary economy, covering the years since 1978, with each sector viewed within the context of China's transitional economy.

This chapter begins by examining some of the assumptions and objectives that China's reformers brought to the transition process. These assumptions led to a distinctive approach to market transition that differentiated China from other formerly socialist economies, ultimately coalescing into a strategy of gradual transformation. The breakthrough in rural China is stressed at the beginning because it was the key early success that drove reforms onward and allowed Chinese reformers to grapple with successively more fundamental issues of transformation. The chapter then lays out a basic framework for China's transition process, interpreting the overall reform process as consisting of two main phases. The first phase of gradualist, dual-track,

decentralizing reforms developed directly out of the rural successes. The basic purpose of this phase was to begin the dismantling of the command economy while maintaining economic growth, an objective that was substantially achieved. Markets were introduced into nearly every area, ownership was diversified, and competition created, all within the framework of the existing institutions. During the second phase, after about 1993, the emphasis of reform shifted as it became more fundamental and thorough. The main accomplishments of this phase have been the remaking of the institutional setup to make it compatible with a market economy, the dramatic shrinkage of the state sector, and the creation of conditions enabling fair competition among all market participants. The second stage is still ongoing. While both phases of reform can be seen to have produced substantial successes, Chinese policymakers still struggle to improve the functioning of the market economy, while coping with the social problems created by transition thus far.

4.1 THE CHINESE APPROACH TO TRANSITION

China's approach to economic transition was quite different from that of most of the other socialist countries. China's leaders viewed China, quite correctly, as a low-income developing country, and the imperative of economic development was constantly on their minds. It was never conceivable to Chinese policy-makers that their economy would postpone economic development until after an interlude of system transformation. It was always assumed that system transformation would have to take place concurrently with economic development, and indeed that the process of economic development would drive market transition forward and guarantee its eventual success. Individual reform policies were frequently judged on the basis of their contribution to economic growth (rather than to transition as such). In the beginning, this approach was followed because reformers literally did not know where they were going: they were reforming "without a blueprint" and merely seeking ways to ameliorate the obvious serious problems of the planned economy. But even after the goal of a market economy gradually gained ascendance in the minds of reformers, it was not anticipated that market transition would be completed until the economy reached at least middle-income status. And in fact, that is exactly what eventually happened.

The approach to transition was starkly different in Eastern Europe and Boris Yeltsin's Russia. In those countries, the predominant objective of committed reformers was to move as rapidly as feasible to a modern market economy. Reformers had a model to aim for—neighboring Western European

economies—and wanted to shed the legacy of Communism as quickly as possible to begin a rapid convergence to this model. Reformers did not believe that their governments could correct distortions in their economy. There were too many distortions, too deeply interrelated. Moreover, those reformers had come to power through the democratic process and had a profound distrust of the Communist Party leaders they had replaced. How could they even be sure that party bureaucrats and planners would follow the instructions of the new governments? It was better to smash the entire edifice, eliminating as many distortions and privileges and the resulting rent-seeking opportunities as possible, and start all over from the bottom up. If in the process there was some short-term loss of output, so be it. This strategy was often called the "big bang." For these reformers, it was of critical importance to free prices as quickly as possible, to let the price system begin to work. It was seen as better to undergo the costs early, in order to lay the foundation for healthy long-term growth later. Subsequent experience, however, showed that those costs were much greater than anticipated.

In contrast, Chinese reformers saw unmet needs everywhere in their economies. Some needs were unmet because China was poor and underdeveloped, and others were unmet because the command economy was wasteful: reformers did not make a fundamental distinction between these two types. The command economy had lavished resources on expensive industrial projects while neglecting simple and easily satisfied demands of consumers. Chinese reformers, in essence, decreed that individuals and organizations should be allowed to satisfy unmet needs and earn some additional income, and if, in the process, this new activity tended to erode the command economy and had to be exempted from some of its rules, so be it. Chinese reformers lowered barriers and gradually opened up their system, giving individuals and groups the opportunity to act entrepreneurially and meet market demands. Early reforms created pockets of unregulated and lightly taxed activity within the system. Reformers allowed such pockets to open up because they were seen as contributing to developmental objectives. For example, rural communities were allowed to run township and village enterprises outside the plan because doing so would contribute to local investment and economic growth. Foreign businesses were allowed to operate freely in special economic zones because that approach would increase investment in China and might convince foreign corporations to transfer technology to China. Such policies were seen as contributing to growth while not initially threatening the overall ability of the government to manage and direct the economy.

As a result, early reforms almost never reduced or eliminated distortions; instead they loosened control over resources so that those distortions

encouraged resources (people, money, initiative) to flow into these less regulated "pockets." Individuals or communities saw "niches" available that they could exploit. First movers made high profits. Only rarely did one see a "level playing field." But this process set up an economic dynamic leading to intensified competition. Gradually, the process of attracting new entrants into "pockets" in the planned economy went far enough that the overall balance between plan and market began to shift. The plan, from having been the solid material out of which a few pockets were excavated by pioneering entrepreneurs, became more like a sponge floating in a sea of predominantly market activity. From this point, achieved by the mid-1990s in most sectors, a new phase of economic reform could begin. The focus of reforms shifted toward dissolving the compulsory plan and creating uniform rules and tax rates for all sectors of the economy. The dual-track plan and market system was phased out, and most prices were unified at market prices. Astonishingly, there was never any "big bang." The process was achieved with a minimum of economic disruption and relative social stability. The contrast is striking to the protracted economic downturn and social upheaval that followed transition in Eastern Europe and Russia.

4.2 HOW DID REFORMS START? THE INITIAL BREAKTHROUGH IN THE COUNTRYSIDE

China's market transition began at the end of 1978 with a wide-ranging reassessment of nearly every aspect of the command economy. Indeed, there was at this time a broad social relaxation after the storms of the Cultural Revolution: political prisoners were freed, millions of sent-down youth returned to the cities, and discussions were relatively free and wide-ranging. In this environment, the extent of the possible was not known, and experimental reforms were launched in nearly every sector of the economy. However, it was in the countryside that reforms succeeded first, and it was the dramatic success of rural reforms that cleared the way for continuing and progressively more profound change (Chapter 10).

The rural reforms began with a simple policy decision: the government should reduce the pressure under which farmers had operated for the previous 30 years. For years, China had been locked into a losing cycle with its farmers: pressured to collect more grain from farmers, procurement targets had been kept high and procurement prices low. But farmers had resisted this unattractive bargain: grain production had grown slowly; farmer marketing had increased slowly; and farmers were unenthusiastic about investing more

time and money in agriculture. At the end of 1978—indeed, at the landmark Third Plenum itself—China's leaders made a decision to ease the terms of trade with agriculture and "give farmers a chance to catch their breath." Procurement targets were stabilized and slightly reduced; procurement prices were raised; and, most importantly, prices for farm deliveries above the procurement target were raised dramatically. These decisions were not easy to make, for they involved substantial trade-offs: in order to pay for the policies, planners in 1979 had to reduce investment, double grain imports in three years, and chop back the ambitious technology import program of the "leap outward" (Chapter 3). The only thing that made these choices palatable to China's leaders was their conviction that the rural economy needed an opportunity for profound restructuring and rehabilitation.

At first, reformers had no clear idea how that restructuring of the farm economy would take place. All farmers were compulsory members of agricultural collectives, and reformers did not initially envision a change in that arrangement, but they were willing to give farmers more breathing space. Reformers at this time were emphasizing the necessity to give enterprises in other sectors expanded decision-making autonomy and better incentives, and the same offer was made to agricultural collectives. Collectives were allowed to experiment with different payment systems for farmers and better ways of organizing and marketing output. Collectives adopted a wide range of innovative approaches, but eventually they began to gravitate toward a radical solution: contracting individual pieces of land to farm households. Farm households took over management of the agricultural production cycle on a specific plot of land, subject to a contractual agreement that they turn over a certain amount of procurement (low price) and tax (zero price) grain after the harvest. This policy essentially recreated the traditional farm household economy, with the collective reduced to being little more than a landlord. Because it implied such a dramatic reduction in the role of the collectives—everything short of abolition—this policy was extremely controversial. But Chinese leaders decided not to block it, and after 1980 they gradually shifted and gave it de facto support.

What happened next was quite astonishing. The institution of contracting land to households spread rapidly throughout rural China and became nearly universal by the end of 1983. Agricultural production began to surge. Helped along by higher prices and the increased availability of modern inputs such as chemical fertilizer, production climbed rapidly through 1984 (see Chapter 11). By 1984 grain output had surged to 407 million metric tons, more than one-third higher than in 1978. There was enough grain for everybody in China. The decades in which China's industrialization had been repeatedly held back by

agricultural weakness seemed suddenly to be over, and the centuries of a China fundamentally short of food were over as well.

In fact, the increase in grain output was only half the story. Freed to allocate their own labor in the way they wanted, farmers increased grain output while actually *reducing* the number of days spent in the grain fields. Instead, they sharply increased their labor input into nongrain crops and nonagricultural businesses. The number of workers in township and village enterprises (TVEs)—locally run factories—increased rapidly, and output from this sector surged as well (see Chapter 12). These TVEs were not incorporated into state plans, so their output either went to meet heretofore unmet market demands or else created new competition for the existing state-owned enterprises. In either case, TVE activity was disruptive and set off profound changes. Successful farm and TVE reforms emboldened reformers, giving them confidence to persist in the reform project. With this background, reformers were prepared to push forward in other sectors where initial efforts had not met with immediate success. Moreover, rural incomes increased rapidly, and reforms gained the support of the bulk of the rural population.

4.3 A TWO-PHASE FRAMEWORK OF ECONOMIC REFORM

Successful rural reforms also reinforced a certain approach to the reform process. Rural reforms had been achieved with little economic or social disruption, largely because a type of dual-track system had been adopted. When farmers contracted for their land, they agreed to turn over a certain amount of grain to the government: the rest was released to the market. Reformers saw in this experience a model of using contracts to stabilize some crucial pieces of the existing economic system while freeing up other pieces. The contracts built in vested interests—in this case, the government and its need to ensure access to grain—while also providing powerful new incentives to farmers, since they kept 100% of the harvest above the contracted deliveries. Reformers sought to extend this approach to industrial and commercial reforms, and in so doing they created a pattern of economic reform that strongly characterized the period from 1978 through about 1993. Reform overall was decentralizing, shifting power and resources from the hands of central planners to local actors, while core interests were protected, often through contracts. This process allowed entry barriers to be reduced and market forces to grow. By 1993, though, this particular pattern of reform had largely run its course. The market sphere had expanded sufficiently that the economy had "grown out of the plan." The focus of policy-makers shifted, as it became increasingly necessary to build a firmer institutional basis for the market economy that was developing. Table 4.1 shows

Table 4.1
Contrasting styles of economic reform

1980s reform	1990s reform
Zhao Ziyang: cautious, consensual decision-making	Zhu Rongji: Rapid, personalized decision-making
Introduce markets where feasible; focus on agriculture and industry	Strengthen institutions of market economy; focus on finance and regulation
Dual-track strategy	Market unification, unite dual tracks
Particularistic contracts with powerful incentives	Uniform rules: "level playing field"
Competition created by entry; no privatization	State-sector downsizing; beginnings of privatization
Decentralize authority and resources	Recentralize resources, macroeconomic control
Inflationary economy with shortages	Price stability, goods in surplus
"Reform without losers"	Reform with losers

the main elements of reform strategy in the two periods, laid out to highlight the contrasts between them.

4.4 ELEMENTS OF CHINA'S TRANSITION THROUGH 1992

In discussing the 1980s (more broadly 1979–1992), the character of China's gradualist transition can be summarized in nine key features, described in the following subsections, which contributed most directly to the period's success. Also, it may not be coincidental that through most of this period the key policy-maker was Zhao Ziyang, premier from 1980 until 1987 and then first party secretary until the Tiananmen Square demonstrations in 1989. Although Zhao was always subordinate to Deng Xiaoping, it was Zhao himself who was responsible for the day-to-day policy-making that steered the Chinese transition through this first period. Zhao had to defer not only to Deng Xiaoping, but also to other senior revolutionary leaders, most important of whom was Chen Yun. Partially because of this political environment, Zhao's policy-making was cautious and gradual, and he had to be able to create at least a passive consensus behind each policy he wished to push forward. Zhao's key challenge was to extricate the economy from the grip of command-economy institutions, which he was able to do. China avoided a Soviet-style collapse by disentangling itself gradually from the institutions of the planned economy.

4.4.1 Dual-Track System

Perhaps the most characteristic feature of China's initial departure from the planned economy was the dual-track system. The Chinese term *shuangguizhi*

refers to the coexistence of a traditional plan and a market channel for the allocation of a given good. Rather than dismantling the plan, reformers acquiesced to a continuing role for the plan in order to ensure stability and guarantee the attainment of some key government priorities (in the Chinese case, primarily investment in energy and infrastructure). The dual track implied a two-tier pricing system for most goods: a single commodity had both a (typically low) state-set planned price and a (typically higher) market price.

It is important to stress that the dual track refers to the coexistence of two coordination mechanisms (plan and market) and not to the coexistence of two ownership systems. By the mid-1980s, most state-owned firms were still being assigned a compulsory plan for some output but had additional capacity available for production of above-plan, market goods. Thus the dual-track strategy was one that operated within the state sector—indeed, within each state-run factory—as well as in the industrial economy at large. This fact was essential because it meant that virtually all factories, including state-run factories, were introduced to the market and began the process of adaptation to market processes. The dual-track system allowed state firms to transact and cooperate with nonstate firms, allowing valuable flexibility. But the growing importance of collective, private, and foreign-invested firms should be considered apart from the dual-track system strictly defined, since most of these firms were predominantly market oriented from the beginning (Wong 1986).

4.4.2 Growing Out of the Plan

The mere existence of the dual-track system is not in itself sufficient to propel an economy in transition to a market economy. In a sense, all planned economies had some kind of dual-track system, because they all had various black and "gray" markets outside the formal planning system. But China planners in 1984 made a broad commitment to keep the overall size of the central-government materials-allocation plan fixed in absolute terms. Since the economy was growing, this commitment implied a gradual process in which the plan would become proportionately less and less important until the economy grew out of the plan. Figure 4.1 shows this process at work with respect to sales and allocation of finished steel, arguably the single commodity most characteristic of the planned economy. Up until 1984 the quantity of steel allocated by central government planners increased in step with production. Unusually in a planned economy, there was also a substantial share of total output allocated by local government planners, which also seems to have been increasing over time. A tiny share of output was sold independently by enterprises. After 1984, though, the quantity allocated by the central government leveled off, and nearly all the increment in output was channeled onto the market, that is, left to the control of enterprises to sell at the best price they could obtain. In the early 1990s quantities allocated began to decline in absolute terms, and then dropped precipitously around 1993. After that point, the economy had grown out of the plan. A generally credible commitment to freeze the compulsory plan set in motion a dynamic process that gradually increased the share of nonplan, market transactions in the economy and made the dual-track system into an unabashed transitional device.

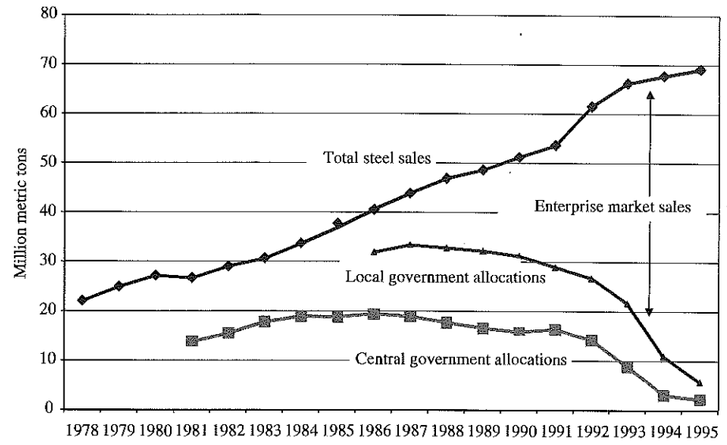

Figure 4.1
Steel production and planned allocation

The commitment to grow out of the plan crucially altered incentives at the level of the individual enterprise. With their plans essentially fixed, enterprises faced "market prices on the margin" (Byrd 1991). Even those firms with compulsory plans covering, say, 90% of capacity, were in a position such that future growth and development of profitable opportunities would take place at market prices. The plan served as a kind of lump-sum tax on (or subsidy to) the enterprise. So long as the commitment not to change it was credible, it really had no impact on any of the enterprise's decision-making. Current decision-making would be based on market prices, and so would profit maximization. In that sense, the plan became irrelevant.

4.4.3 Particularistic Contracts

In order to make the dual-track system work, planners signed individual contracts with every state-owned enterprise. These contracts specified tax payments and contributions to the material-balance plan (somewhat on the model of the rural household contracting system). In practice, this policy meant there was no regular tax system—the de facto tax rate was specific to an individual enterprise. Each contract was drawn up on the basis of the firm's performance in a previous base year, so that each existing enterprise was grandfathered into the transitional system (see Chapter 13).

4.4.4 Entry

The central government's monopoly over industry was relaxed. In China the protected industrial sector was effectively opened to new entrants beginning in 1979. Large numbers of start-up firms, especially rural industries, rushed to take advantage of large potential profits in the industrial sector, and their entry sharply increased competition and changed overall market conditions in the industrial sector. Most of these firms were collectively owned, and some were private or foreign owned. The crucial factor is that the central government surrendered in practice its ability to maintain high barriers to entry around most of the lucrative manufacturing sectors. This lowering of entry barriers was greatly facilitated in China by the nation's huge size and diversity, as well as the relatively large role that local governments played in economic management even before reform. Large size and diversity meant there was scope for competition among firms in the "public sector," even if each of these firms remained tied to government at some level.

4.4.5 Prices Equating Supply and Demand

Flexible prices that equated supply and demand quickly came to play an important role in the Chinese economy. Beginning in the early 1980s a significant proportion of transactions began to occur at market prices, and in 1985 market prices were given legal sanction for exchange of producer goods outside the plan. Consequently, state firms were legally operating at market prices, since virtually all state firms had some portion of above-plan production. Gradual decontrol of consumer goods prices—initially cautious—steadily brought most consumer goods under market-price regimes. An important benefit of the legitimacy given to market prices was that transactions between the state and nonstate sectors were permitted, and they developed into a remarkable variety of forms. Simple trade was accompanied by various kinds of joint ventures and cooperative arrangements, as profit-seeking state-run

enterprises looked for ways to reduce costs by subcontracting with rural nonstate firms with lower labor and land costs.

4.4.6 Incremental Managerial Reforms Instead of Privatization

State-sector managerial reforms were carried out as an alternative to a more radical policy, privatization. As state firms faced increasing competitive pressures, government officials experimented with ways to improve incentives and management capabilities within the state sector. This experimental process focused on a steady shift in emphasis away from plan fulfillment and toward profitability as the most important indicator of enterprise performance (Chapter 13). There is substantial evidence that the combination of increased competition, improved incentives, and more effective monitoring of performance did improve state-enterprise performance over the 1980s. Logically there is no reason why privatization could not be combined with a dual-track transitional strategy, but practically there are obvious reasons why there would be alternatives. Urgent privatization tends to follow from a belief that state-sector performance cannot be improved, and often leads to a short-run "abandonment of the enterprise" as the attention of reformers shifts away from short-run performance and to the difficult task of privatization. Conversely, the sense that privatization is not imminent lends urgency to the attempt to improve monitoring, control, and incentives in the state sector. Clearly, the Chinese approach worked adequately during the early stages of transition. But debate continues about whether the moderate performance improvements in the state sector that were achieved were large enough to be judged successful.

4.4.7 Disarticulation

Along with measures to reform the core of the planned economy, Chinese reforms also advanced by identifying economic activities that were the least tightly integrated into the planning mechanism and pushing reform in these limited areas. Early reforms followed a strategy of "disarticulation," in which successive sections of the economy were separated from the planned core. This was clearly not an intentional strategy, but rather one that emerged from the nature of the policy process and from the concern of Chinese policy-makers not to disrupt the core economy. The early establishment of special economic zones is the most obvious example of such policies—export-oriented enclaves were created that had, initially, almost no links to the remainder of the economy (see Chapter 17). This approach is also one of the reasons that reforms succeeded first in the countryside. Policy-makers realized that it was not necessary that all the countryside be integrated into the planned economy.

Beginning with the poorest areas, some regions were allowed to detach from the planned economy. So long as the state could purchase sufficient grain to keep its storehouses full, it could afford to let the organizational form in the countryside devolve back to household farming. Caution led to a strategy of disarticulation.

4.4.8 Initial Macroeconomic Stabilization Achieved Through the Plan

When China's reformers faced serious macroeconomic imbalances in 1979–1981, they used the institutions of the planned economy to cut back investment and relieve pressure on the economy. Rather than combining stabilization and reform into a single rapid but traumatic episode—as in a "big bang" transition—the Chinese used the instruments of the planned economy to shift resources toward the household sector and relieve macroeconomic stresses at the very beginning of reform. This dramatic shift in development strategy created favorable conditions for the gradual development of markets. Inflationary pressures were vented off as supplies grew, rather than being resolved in a quick transition from suppressed to open inflation. In a related fashion, the planning structure was used to provide an initial impetus away from the capital-intensive Big Push strategy and toward more sustainable labor-intensive sectors. This initial shift toward a more labor-intensive strategy was given urgency by the need to provide jobs for a large group of unemployed young people, including many who had returned to the cities from the countryside. Clearly, planning would be an unwieldy and ineffective instrument to carry through such a shift over the long term. But the temporary use of this instrument to lower unemployment tended to preserve stability and solidify support for the reform orientation.

4.4.9 Continued High Saving and Investment

Continued high saving and investment were made possible by a gradual takeover of national saving from government by households (Chapter 18), made possible by macroeconomic stability. The Chinese government intentionally reduced its share of GDP during the early stages of reform in order to allow rural and urban households more resources and better incentives. Fortunately the steady increases in household income and the increasing opportunities in the economic environment led to a rapid increase in household saving. The fact that households were willing to rapidly increase their voluntary saving was a side benefit to the relatively stable economic environment reformers purchased through gradualist reforms. Rapidly increasing household saving indicates that households believed their assets would be reasonably secure. In turn, household behavior contributed to macroeconomic stability because it offset the reduction in government saving that took place at the same time. Reduced government saving was due to a steady erosion in government revenues, which itself was ultimately traceable to the dissolution of the government industrial monopoly. Total national saving remained high, thereby sustaining high levels of investment and growth. An indirect consequence was a vastly enhanced role for the banking system, serving as an intermediary channeling household saving to the enterprise sector. While this process was relatively smooth, it was difficult for the government to acquiesce in and to manage the decline in its resources, and macroeconomic policymaking became more complex and more difficult.

4.4.10 Conclusion of First-Phase Reforms

On balance, and in retrospect, the policies described here can be seen to have a clear coherence and to have been overwhelmingly successful. Reduction of the state's monopoly led to rapid entry of new firms. Entry of new firms combined with adoption of market prices on the margin led to enhanced competition and began to get state-sector managers accustomed to responding to the marketplace. Gradual price decontrol was essential. Competition eroded initially high profit margins for state firms and induced the government, as owner of the firms, to become more concerned with profitability. The government experimented with better incentive and monitoring devices, and this experimentation improved state-sector performance. Nonetheless, the state sector grew more slowly than the nonstate firms that were entering new markets. The economy gradually grew out of the plan, as both the plan itself and the state sector as a whole became less dominant elements in the economy. Yet this growth occurred with economic continuity that was attributable to the maintenance of a small planned sector as a kind of stabilizer, as well as to robust saving and investment that powered continued economic growth.

However, the ultimate success of the first-phase reform process was not always self-evident while it was ongoing. On the contrary, reform was always contested, and the achievements of reform were constantly subjected to harsh scrutiny from conservatives who were skeptical of reform. One result of this policy competition was a pattern of "two steps forward, one step back." Reforms seemed to advanced strongly in certain years (1979, 1984, 1987–1988) and retreat in other years (1981–1982, 1986, 1989). Relating to these policy cycles, macroeconomic cycles also persisted throughout the reform process. Bold reform measures tended to be implemented after stabilization had achieved some success. Reform measures then contributed to renewed macroeconomic imbalances, eventually leading to a new period of macroeconomic

austerity. As a result, the outcome of macroeconomic policies was frequently fundamental in determining the success or failure of specific reform initiatives (see Chapter 18). Oddly, this pattern of "political business cycles" mirrors the experience in the socialist economy; after 1978, however, the expansionary phases were phases of accelerated reform, rather than phases of political mobilization.

At times, these macroeconomic cycles yielded a side benefit. Planners were unable to keep up with rapidly changing cycles and were buffeted by rapid changes in economic conditions. The almost intractable task of planning an economy can only be carried out in conditions of artificially imposed stability; without that stability, the inadequacy of attempts to plan the economy became increasingly evident. But individual cycles also imposed very substantial costs on the economy, as well as undermining political support for reformist politicians. Indeed, by far the most serious challenge to the reform process came in the wake of just such a cycle, when deteriorating cyclical economic conditions in 1989 fed an upsurge of urban discontent.

4.5 THE TIANANMEN INTERLUDE

During 1988–1989 one of the severe cycles of macroeconomic imbalance described in the previous section led to a serious political crisis. Urban discontent in 1989 was fueled by a number of factors: rising inflation that eroded real incomes, anger at corruption and arbitrary privilege, and rising expectations about political and economic change. All these feelings were powerful motivating factors to students who poured into Tiananmen Square in central Beijing to mourn the unexpected death of Hu Yaobang, who had been an important reformist leader. Hu, in fact, had been particularly respected because of his willingness to fully rehabilitate more than a million Chinese who had been scapegoated and persecuted by either the Anti-Rightist Campaign or the Cultural Revolution, or both. A volatile mixture of expectations and grievances fueled extravagant hopes and massive disillusionment, and led to months of demonstrations in China's main square. Reformist leader Zhao Ziyang refused to order the military to clear the square by force. Ultimately, Zhao was ousted, and conservative leaders ordered the military into the square. Hundreds were killed, many of the most influential reformists in the government were sidelined or exiled, and the course of China's reform was forever altered.

However, the process of market transition resumed after about two years of backsliding. Economic reforms were able to survive because of the broader

dynamics of the process. Certainly, economic causes were an important part of the social crisis leading up to the Tiananmen debacle. Soaring inflation during 1988–1989 ate away at real urban incomes that had been protected for most of the 1980s. A sense that the government was failing to honor a kind of implicit social compact with urban residents fueled discontent. At the same time, the measures that had been taken to curb inflation were already starting to bite into economic growth and cause expectations of the future to be revised downward. In this difficult short-term environment, the sense that political promises had been betrayed and political reforms were running off the tracks fueled a powerful sense of disillusionment and protest.

Yet from a long-term perspective, it is more striking that it was very rare for a major social group to suffer significant economic losses during the 1980s. In particular, the position of workers in state-owned enterprises (SOEs) was protected during the course of reform. The resulting pattern has been labeled "reform without losers" (Lau, Qian, and Roland 2000). Rural residents gained from the dissolution of collectives, improved agricultural prices, and the rapid growth of nonagricultural production in the countryside. Urban residents gained either because they were able to exploit new niches in the economy or because their economic position was protected by continuing government support for state enterprises. The broad enjoyment of the benefits of reform—and the absence of a group clearly disadvantaged by reform—meant that reform was still widely popular, despite the debacle at Tiananmen Square.

After the Tiananmen Square political crisis, a period of conservative ascendancy followed, between 1989 and 1991. The conservative attempts to roll back reforms were completely without success, however, and are often forgotten. Urban inflation, which had seemed so corrosive in 1988, was in fact quickly controlled, and market forces corrected other imbalances in the economy with a speed that surprised conservatives and left planners far behind. As it became clear that the conservatives had no viable program, their support among the Communist Party elite began to crumble.

It was in this situation, as the pendulum was swinging back toward renewed reform, that Deng Xiaoping himself emerged to give that pendulum a forceful push. In early 1992, Deng took a "Southern Tour" that had him visit the SEZs he himself had authorized more than a decade earlier. Deng gave a ringing endorsement to the concept and reality of the SEZs, a traditional bellwether of Chinese Communist elite opinion. Deng reemphasized the need for accelerated economic reform and specifically reaffirmed a nonideological, pragmatic approach to experimentation. "Development is the only hard truth," Deng declared, "It doesn't matter if policies are labeled socialist or capitalist, so long as they foster development." Deng's pronouncements were

about principles, not practical policies, but they were sufficient to restore the government's commitment to economic reform and tip the balance of political power in Beijing. In October 1992 the 14th Congress of the Communist Party convened and endorsed a "socialist market economy," making clear that markets must extend to all main sectors of the economy. This was one of Deng Xiaoping's last decisive personal interventions in Chinese policy-making. Of course, while Deng's advocacy was sufficient to reignite economic reform, Deng was unwilling and perhaps unable to resume progress in political reform. As a result, Deng's legacy ultimately included an unbalanced combination of vigorous economic reforms and relative political stagnation.

4.6 THE SECOND PHASE OF REFORM, 1993–PRESENT

The post–Deng Xiaoping leadership was associated with a new phase of economic reform, but one that developed organically out of the earlier phase. In economic policy the figure of Zhu Rongji quickly emerged as the most important voice. Zhu established himself as the dominant voice in policy-making in mid-1993, while he was still vice premier, and was then formally elevated to premier in early 1998. Zhu's policy-making was rather different from that of his most important predecessor, Zhao Ziyang. Zhu had a strong, decisive personality and often made quick, personal decisions. Zhu presided over much of the second period of economic reform, until he stepped down as premier in 2003.

The contrasts between this period and the preceding one were shown schematically in Table 4.1. Key features of the second phase of reform can also be conceptualized in terms of prerequisites, regulatory changes, and outcomes. Three policy measures were essential prerequisites to the overall package: ending the dual-track system, recentralization of fiscal resources, and macroeconomic austerity. Having established a firm macroeconomic policy base, reformists shifted to a focus on regulatory and administrative restructuring in the key market sectors: the banking system, the tax system, the system of corporate governance, and the external sector, through membership in the WTO. The outcomes of this policy regime were a shift from inflation to price stability, a dramatic downsizing of the state-enterprise sector, the acceptance of a moderate amount of privatization, and the emergence of a "reform with losers." Zhu Rongji's policies were consistently associated with stronger, more authoritative government institutions and more decisive policy-making.

4.6.1 Prerequisites

4.6.1.1 Market Reunification

By the early 1990s the dual-track system had served its function. Figure 4.1 shows that after 1991 allocation of materials (in this case, steel), after having been kept constant for several years, dropped off rapidly. By the end of 1993, material-balance planning was abolished altogether. The orthodox planning system disappeared with barely a whimper, scarcely noticed. Particularistic contracts with individual enterprises were also allowed to lapse. One side of those contracts had become obsolete (delivery of within-plan output), while the financial side was in conflict with impending fiscal and tax reforms, which were high on the reform agenda.

4.6.1.2 Recentralization

It seems paradoxical that centralization could be a main tenet of reform in the second reform era, when decentralization had been a key part of the first era of reform. In fact, though, it was essential that further economic reforms develop a more appropriate division of responsibilities between central and local. During the first period of reform, the motivating force behind decentralization had been the need to introduce markets and incentives into the system. During the second period, management responsibilities were more clearly divided between center and local, but in a way that tended on balance to be recentralizing in terms of the ultimate control of resources. The central government needed to strengthen its regulatory and macroeconomic management functions. In order to do so, it also needed to establish an adequate and reliable source of finance revenues, which it was able to do. Figure 4.2 shows the outcome, a fundamental turning point in 1995. During the course of more than 15 years of reform, China's fiscal position had eroded significantly, dropping from 33.8% of GDP in 1978 to only 10.8% at the low point in 1995. The decline of budgetary revenues was driven primarily by the inexorable erosion of the old system in which state enterprises raised revenues from their monopoly position. More generally, fiscal decline was also the logical result of a transition strategy that stressed decentralization of authority and benefits, along with releasing resources from government control to the marketplace. Despite the successes achieved in transition, by the early 1990s it was widely perceived that China had a serious fiscal crisis. Key fiscal reforms—discussed in Chapter 18—provided a new, broader tax base for the economy and led to a steady revival of government budgetary collections. From 1995 onward, a modern tax system was gradually built up.

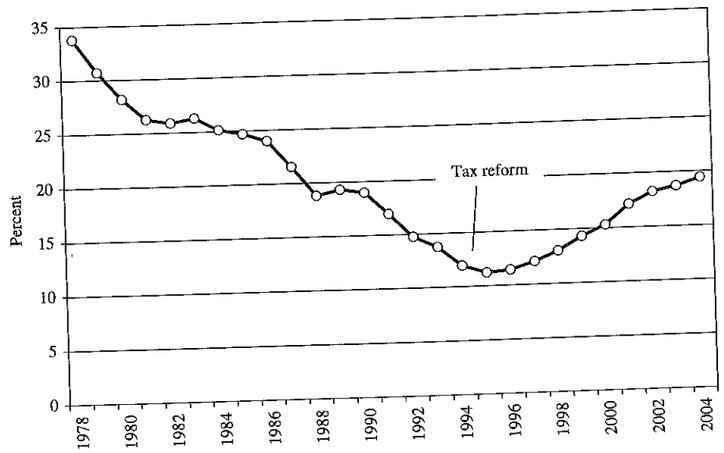

Figure 4.2
Budgetary revenue share of GDP

4.6.1.3 Macroeconomic Austerity

Macroeconomic austerity was both a short-term and a long-term necessity. In the wake of Deng Xiaoping's Southern Tour a gold rush mentality of speculation and financial excess quickly led to a surge of bank credit and accelerating inflation. Zhu Rongji made his mark by initiating a tough period of macroeconomic austerity in mid-1993. A financial crackdown was clearly necessary, but it turned out that this crackdown signaled the beginning of a new macroeconomic policy regime, which delivered much less cheap credit to state-owned enterprises and a slower growth of money and prices. By 1997 at the latest, it was clear that Chinese policy had shifted to a long-term policy of macroeconomic conservatism and had managed to deliver a significant degree of macroeconomic stability (see Chapter 18). This shift was an essential prerequisite to making public enterprises responsible for their own profits and losses, providing them with a "hard" budget constraint. Tough macroeconomic policies created conditions under which further enterprise restructuring was driven primarily by market forces.

4.6.2 Regulatory Approach and Administrative Restructuring

Zhu Rongji also presided over a new, more regulatory approach to economic reform. The new reforms were regulatory in the sense that they introduced

new rules (and new prices) that at least in principle applied equally to all economic actors. There was more focus on creating and regulating competition as a force for economic change and less on direct government action in managing productive enterprises. By the 1990s, with the economy having "grown out of the plan," the most important tasks were to improve the legal and regulatory environment, create a "level playing field," and reduce some of the most obvious distortions in the economy. Regulatory and administrative reforms in the four most important sectors of the economy are described in the following sections. The commitment to this new direction was strongly signaled early on, when three crucial measures—a new fiscal system, a new foreign trade system, and the new Company Law—were made effective on January 1, 1994.

4.6.2.1 Fiscal and Tax System

Fiscal reforms in 1994 were designed to arrest the slide in budgetary revenues, but also to transition to a broader tax base by implementing a 17% value-added tax and other business taxes. These taxes had relatively low rates, compared to the old system, but they were uniform and applied to all economic actors. The strong performance of tax revenues after 1995 showed that broadening the tax base was successful. Fiscal reforms were also designed to put central-local government fiscal relations on a sounder and more stable basis. They did so by increasing the share of total taxes initially collected by the center and establishing a set of rules for sharing revenues between central and provincial governments (see Chapter 18).

4.6.2.2 Banking and Financial System

The banking system underwent fundamental restructuring during the second half of the 1990s. The People's Bank of China (PBC) had been nominally established as a central bank in 1983, but at that time it remained beholden to government officials at both central and provincial levels. The bank was finally given a workable organizational structure in late 1998, when a restructuring plan abolished the provincial-level branches and set up nine regional branches along the lines of the U.S. Federal Reserve Board. Combined with a renewed mandate to conduct monetary policy, and with a monetary policy board established as a governance and advisory body, the central bank began to play an active role in determining and implementing monetary policy. This administrative restructuring took place in tandem with the adoption of macroeconomic austerity: state-run commercial banks soon found themselves facing a much harder budget constraint, as their access to easy government money was curtailed. In turn, they began to pass tougher standards on to their clients in state-owned enterprises.

Shortly after the constitution of a central bank system, banking authorities began to tackle the enormous problem of lax financial supervision and nonperforming loans in all the state banks. In 1999 four asset management corporations were established to take over some of the nonperforming loans of the four big state commercial banks and begin to liquidate them for as much residual value as possible. Clearly, these are essential steps on the long and difficult road to a stable banking system. Eventually, in April 2003, the PBC supervisory functions were spun off to the newly created China Bank Regulatory Commission (see Chapter 19).

4.6.2.3 Corporate Governance

A large-scale effort to restructure the state-owned corporate sector was begun with the passage of the Company Law at the end of 1993. The Company Law contained provisions for all state-owned enterprises to gradually reorganize as limited-liability corporations with clarified corporate governance institutions. These provisions have been only gradually implemented but have slowly transformed the organizational structure of the Chinese public sector (see Chapter 13). The systematic restructuring of corporate governance was combined with selective listing of state-owned companies on China's newly opened stock markets, which grew significantly during the late 1990s (Chapter 19). Together these measures changed the structure of China's large state-owned companies and created a demand for government regulation that had not previously been evident. With implementation of a securities law in July 1999, the China Securities Regulatory Commission's (CSRC) branches became operational nationwide, thus forming a centralized and unified network of securities supervisors. At the same time, a host of new central government agencies were established to deal with other types of regulatory oversight, including, for example, the State Intellectual Property Office and the State Administration of Technical and Quality Supervision. China began to make progress toward a regulatory state.

4.6.2.4 External Sector: Membership in the World Trade Organization

Extensive foreign-trade reforms were passed at the end of 1993 that unified China's foreign exchange regime, devalued the currency, and established current-account convertibility. These were important steps forward that Chinese authorities expected to clear the way for membership in the WTO. As it turned out, an arduous process of negotiation and compromise was required before China finally acceded to the WTO in December 2001. Accession involved Chinese acceptance of an extraordinarily broad range of regulatory undertakings, designed to allow China to harmonize with international standards. At the same time, and even more fundamentally, WTO accession implied an important further step in the degree of openness of the Chinese economy and in the extent to which foreign goods and companies could compete in China.

4.6.3 Outcomes

4.6.3.1 From Inflation to Price Stability

After 1996, Chinese inflation was tamed. Although cycles were not completely eliminated—another expansionary phase emerged after 2002—the overall macroeconomic context swung sharply toward price stability. The context of price stability and increased competition greatly intensified the product market pressure on Chinese firms, especially public enterprises.

4.6.3.2 State Enterprise Restructuring and Downsizing

From the mid-1990s, Chinese authorities began to cut the formerly close ties that bound government and state-owned enterprise. Public firms faced increased product market competition and pressure, on the one hand, and reduced access to funding from government banks, on the other. Gradually state-owned enterprises moved toward a significant restructuring and downsizing, encouraged by the government. State-enterprise restructuring has meant converting vaguely defined public ownership into more explicit, legally defined ownership categories, sometimes involving privatization. Following the 15th Communist Party Congress in September 1997, local government officials were given an almost free hand to proceed with state-sector reforms that included bankruptcy, sales and auctions, and mergers and acquisitions. Throughout the 15 years of economic reform, between 1978 and about 1993, although the state sector had shrunk in relative importance, it had continued to grow in absolute terms, both in output and in employment. As Figure 4.3 shows, since the mid-1990s state-enterprise employment has declined dramatically. While some of these workers are in firms that remain government controlled (but no longer traditional state-owned), the overall size of public enterprise employment dropped by more than 40%.

Given the decentralized nature of the Chinese economy, the progress of state-owned-enterprise restructuring depended on the incentives facing local governments, which "owned" the majority of SOEs. In fact, SOEs had already ceased to be "cash cows" on which local government officials could draw: Industrial SOE profits were 15% of GDP in 1978, but fell below 2% of GDP in 1996–1997. Local governments began to rethink the value of possessing

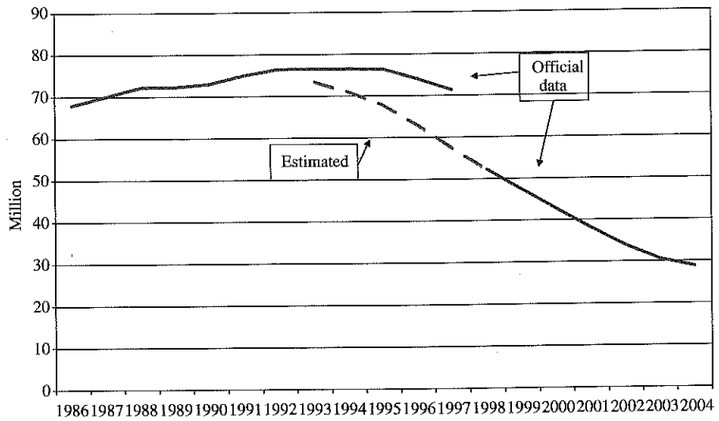

Figure 4.3
SOE workers

their own SOEs and increasingly concluded that they derived few advantages from local state ownership that could not be achieved just as well from a generally prosperous local economy.

4.6.3.3 Privatization

The Chinese government has never unambiguously embraced privatization and continues to avoid the term in favor of vague circumlocutions such as "restructuring." However, privatization, often in the form of management buyouts, became common in the TVE, collective, and SOE sectors after the mid-1990s. More generally, private businesses have been given gradually increasing recognition and legitimacy. Indeed, the rise of private business is perhaps an inevitable consequence of a policy shift toward a level playing field. By the end of 2004 the urban private sector, without counting foreign-invested firms, employed about twice as many workers as the traditional state sector: 55 million, compared with less than 30 million in SOEs.

4.6.3.4 Reform with Losers

The momentous changes in transition strategy have broken sharply with one of the key characteristics of reform in the early period. Reform after 1993 clearly imposed significant losses on substantial social groups. Most directly affected were state-enterprise workers, who had been a relatively privileged

group in the past. Millions have been laid off, and further millions have abandoned failing firms (see Chapter 8). Subject to employment uncertainty for the first time since the establishment of the PRC, some state workers suffered precipitous losses in income and social standing. In general, groups and individuals are less sheltered from competition than in the past. Thus, while transition has continued to move ahead, the benefits of transition are now far more unequally spread among the Chinese population than was the case in the 1980s.

4.7 CONTEMPORARY CHALLENGES

The shift in transition strategy around 1992–1993 means that China's approach to transition is now somewhat less distinctive than it was previously. Economic policy-making in China now more closely resembles that in other transitional economies, such as Poland and the Czech Republic, and there is no longer a polar opposition between "big bang" and "gradualist" transitions. Reformers in both groups of transition economies now focus on maintaining stable and consistent fiscal and financial policies, and both are engaged in building a regulatory environment that can reduce corruption, support an advanced market economy, and protect fair and equal competition. The qualitative responses to the challenges of transition are now more similar.

Nevertheless, the Chinese experience has many valuable lessons to teach. These lessons come from a broad view of China's transition, however, and not from specific policies that should be transplanted to other economies. After all, the Chinese policy-making process has been extremely complex, and produced dramatically different outcomes in different periods of "gradualist" transition. Discussions of China's transition have often failed to make this clear. Sachs and Woo (1994), for example, argue that the successes of China's early reforms were actually due to the advantages of underdevelopment, which gave China a relatively large, flexible, rural economy that served as a seed-bed of reform. However, underdevelopment surely has costs as well as benefits, and is unlikely to be make reforms unambiguously easier. The early reforms were successful precisely because they were effectively adapted to the specific challenges and opportunities provided by China's situation at that time. Second-stage reforms were then dramatically recast and adapted to a whole new set of challenges and opportunities. As McMillan (2004) points out, the lesson is not that a specific set of circumstances provides intrinsic advantages, but rather that careful policy-making, firmly grounded in local conditions, has a much better chance of success than prepackaged policy

prescriptions. Moreover, policies that give weight to development of social and economic capabilities will be more successful than policies that overemphasize institutional changes. As Deng Xiaoping said in the midst of China's transition process, "development is the only hard truth."

Despite the remarkably successful record of transition thus far, there is no guarantee of continued success in the future. In 2003, a new administration took over in China. Hu Jintao became the top Communist Party official and government leader. Wen Jiabao succeeded Zhu Rongji as premier, and continuing the transition-era division of responsibility, immediately became the predominant economic policy decision-maker. Under Wen, the style of policy-making has changed rather dramatically, becoming more consultative and deliberate than under Zhu Rongji. The fundamental policy direction has not significantly changed, although the policy agenda has broadened. It has become clear that policy-makers today face the dual challenge of advancing the transition process while also cushioning the impact of changes that have increased inequality and reduced economic security. On the one hand, the transition process is far from complete; on the other hand, problems created during the second phase of transition urgently require remedial action.

The second phase of transition was far more profound and thorough than the first phase, but in many areas the institutions created are still far from adequate. The financial system (Chapter 19) remains dominated by state-owned banks and subject to influence by government and well-connected insider groups. Weak legal accountability finds its reflection in the financial system in a trail of nonperforming loans and bad assets, followed by government bailouts. The tax system has been reconstructed but fiscal relations between central and local governments are still weakly specified, and local fiscal capacity gravely underdeveloped (Chapter 18). Chinese corporations have been given a coherent legal charter, but most are far from developing world-class standards of corporate governance and the ability to compete in the global marketplace (Chapter 13). Chinese regulatory agencies have been created, but they are still not fully independent from the government management bodies from which they were originally "hived off." This list could be extended but the key challenges and focus of reform remain strengthening the financial, fiscal, and regulatory apparatus and building the institutions of a sophisticated market economy.

The specific challenges are changing and becoming, in a sense, more "political." China is struggling to develop a broader and sounder system of ownership, with a stronger, and more transparent system of property rights. The need to develop a legal and regulatory system is increasingly urgent, and the demand for legal rights and regulatory fairness is increasingly widespread in

the population. But thus far, progress in developing a regulatory apparatus has been limited by the fact that transparency, accountability, and oversight run into limits when they touch on the ultimate structure of political power. China's reformers have made numerous efforts to strengthen checks and oversight within the system, but they all ultimately rely on a kind of self-policing by the CCP. The economy is still politicized, and powerful interest groups frequently involve the cooperation of political and economic elites. Under these circumstances, corruption is inevitably a serious problem, both in its own right and because of the way it obstructs resolution of other problems. A true "level playing field" remains to be created.

A different set of challenges face China's reformers as they struggle to cushion the impact of economic changes on vulnerable sectors of the population. Inequality has increased sharply (Chapter 9), and economic life has become much more uncertain. In the rural sector, incomes have increased but have lagged stubbornly behind urban incomes. Chinese policy-makers used the first phase of transition very effectively to build support for further reforms. As mentioned previously, reform in the 1980s was a kind of "reform without losers," making some better off without significantly harming any major group. But this set of benign social outcomes was sacrificed after the mid-1990s. Unable to indefinitely protect SOEs from competition, reformers shrank the state sector quickly. Not surprisingly, once policy-makers made up their minds to "smash the iron rice bowl" and downsize the state-sector, marketization leapt ahead, even though pension and health-insurance programs were far from complete. As a result, significant segments of society, in both urban and rural areas, feel left out of the prosperity they see developing around them. Reformers need to carry out remedial work, repairing some of the holes that have developed in the urban social safety network, and bringing some basic social security protections to rural workers. More broadly, reformers need to ensure that reforms bring as many economic benefits as possible to a large majority of the population, protecting the more vulnerable sections of the population while also, incidentally, reinforcing the pro-reform sentiments that developed during the 1980s.

Indeed, the post-2003 Hu Jintao–Wen Jiabao administration immediately shifted the rhetorical emphasis of the government toward greater solicitude, toward rural areas, and toward regions and individuals left behind in the development process. Expressions of good intentions have been followed by significant policy changes that, for example, have reduced the tax rate in rural areas, and eliminated some of the unreasonable extra burdens that rural-to-urban migrants experience in cities. Still, these shifts in orientation need to be reinforced by effective policies that bring the benefits of growth more

inclusively to a broader swath of the population. This will not be easy. Current policies lock in the growth of an increasingly competitive and open economy. The commitments to the WTO, of which China became a member in December 2001, limit China's ability to protect large sections of the economy from international competition. This will inevitably accelerate the pace at which the market discriminates between successful and unsuccessful market competitors. While this process is driving the creation of a more productive and competitive economy, it also increases the urgency for China to provide effective policies to ease the transition of millions out of obsolete, low-productivity jobs, and speed their finding of productive roles in the emerging economy. Only if the benefits of reform are broadly spread will China be able to make the next step to a highly functioning market economy.

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Suggestions for Further Reading

Wu (2005) has the best comprehensive coverage of China's transition. For a quick introduction to the contending perspectives on China's gradualist approach versus the Russian and Polish "big bang," see McMillan (2004) and Havrylshyn (2004). Some key works that discuss transition in Eastern Europe and in China include World Bank (1996), Sachs and Woo (1994) and McMillan and Naughton (1992).

Lau, Qian, and Roland (2000) introduced the analytic concept of "reform without losers," which serves as the basis for the two periods of reform used in this text. Qian (2003) is also an absorbing account. Naughton (1995) covers the period through 1993 in more detail. Qian and Wu (2003) adopt a similar two-period interpretation.

Sources for Data and Figures

Figure 4.1: Naughton (1995): 224.

Figure 4.2: *SYC* (2005, 271, and preceding years). Official data have been adjusted to make the categories consistent over time and comparable with international conventions. Official data treat subsidies to loss-making state enterprises as a negative revenue item; these subsidies have been added to both revenues and expenditures.

Figure 4.3: *SYC* (various years) and statistics published hy the Ministry and Labor and Social Security (various years). See Chapter 8 for discussion.

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20 Environmental Quality and the Sustainability of Growth

For centuries the pressure of population on China's limited natnral resonrces has led to severe environmental degradation. A hundred years ago most of China had already been stripped of forests. Modern economic growth has created another set of challenges, creating massive pollution and apparently unsustainable demands on natural resonrces. Many regions of China present a picture of rapid economic growth and severe environmental damage. How serious are China's environmental problems? Do they threaten to undermine the progress being made toward a higher quality of life for the majority of Chinese citizens? This chapter provides an introdnction to China's environmental problems without attempting to provide a definitive answer to these qnestions.

Economists frequently view environmental issues through the lens of the "environmental Kuznets curve." According to this conception, pollution and other environmental problems worsen during the early stages of economic growth and then begin to improve as a conntry reaches middle-income status. There are technological and preference-related arguinents for this pattern. In terms of technology, early stages of industrialization often involve rapid spread of relatively crude production techniques that, while relatively easy to master, produce lots of by-products and pollution. Subsequently a broader technological capability gives access to cleaner and more efficient production techniques. In terms of preferences, poor people understandably place priority on economic growth to increase income and consumption. Public environmental quality is a "luxury good," and demand for environmental quality at low income levels is therefore initially limited, but it increases rapidly as incoines grow above a certain level. This viewpoiut implies a certain degree of optimism about environmental problems, because it suggests that countries will develop the ineans and the will to tackle their own environmental issnes as they develop.

There is considerable debate as to whether the environmental Kuznets curve accurately describes the variety of developing-conntry experiences

(Stern 2004). Nevertheless, it is a good tool for organizing a brief discussion of China's environmental problems. Clearly, China has experienced significant environmental deterioration over the past 20 years. Thus there is evidence to support the idea that China is on the downslope of the Kuznets environmental quality curve. But the Kuznets curve reminds us of that ultimate environmental quality is the outcome of many contending economic, technological, and social forces. There have been significant areas of environmental progress in China over the past 20 years, and there is growing concern among the population and in government policy-making circles about environmental problems in China. The capability to analyze environmental problems and the ability to implement and pay for cleaner and more efficient production techniques have grown. It is sometimes said that China's breakneck growth has been purchased at the cost of the environment but this contrast is far too simple. Growth has worsened many environmental problems but development has also brought China the means to address other environmental problems. We cannot yet discern whether these contending forces have enabled China to turn the corner to the upslope of the environmental Kuznets curve.

Emblematic of the growing environmental awareness in China is the growth of a national environmental policy and administrative structure. Environmental agencies were created during the 1980s, and the National Environmental Policy Agency (NEPA) gained administrative independence in 1988. During the March 1998 government downsizing, environment bucked the small-government trend, and the renamed State Environmental Policy Agency (SEPA) was promoted to ministerial status. Local governments down through the county level all have environmental bureaus. NEPA (1993) laid out a daunting list of China's major environmental problems, all of which are likely to have long-term effects both on natural ecosystems and on economic growth.

We can divide environment problems into two broad groups (Figure 20.1). The first group refers to pollution in the broad sense. Pollution causes the largest current costs. Urban air pollution causes more than 100,000 excess deaths annually, and millions of dollars in health costs. China's air is dirty, and getting dirtier. At the same time, pollution is the aspect of the environment most susceptible to a degree of optimism based on economic development and changing population preferences. China's urban air today is not dirtier than the air in major Western cities in the 1950s, and China's citydwellers are beginning to demand improvements in the air they breathe. The second group refers to the sustainability of resource use. In these cases, economic activities result in impairment of the natural system's ability to replenish itself, but the costs of this resource depletion are not necessarily apparent in today's economy.

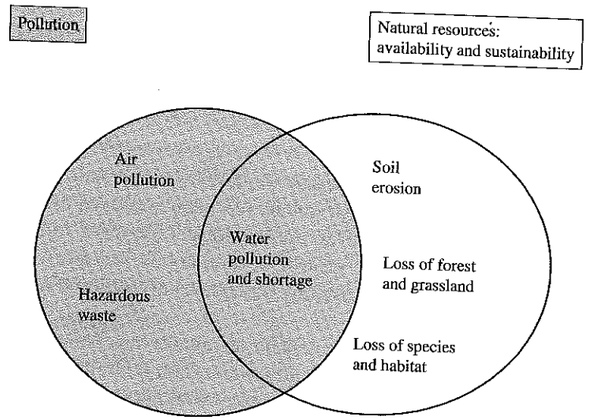

Figure 20.1
Pollution and resource sustainability

Indeed, some degree of depletion of resources might never lead to problems. However, because we do not know exactly where the boundaries of excess depletion begin, or what the carrying capacity of the system will turn out to be, these sustainability issues might present the greatest long-run challenges to well-being. Water is the critical resource in both groups, because it is highly polluted and currently being exploited in an unsustainable fashion. Water is the most important area of intersection between pollution and sustainability concerns. The other area of greatest long-term concern is the impact on the atmosphere from China's enormous and growing reliance on coal for energy production. Even though China has greatly improved the efficiency with which it uses coal, its rapidly growing economy will steadily increase that amount of coal it uses, produce more local air pollution, and contribute to greenhouse gases and global warming.

20.1 POLLUTION

Air and water pollution are damaging to human health, worker productivity, and agricultural output. As the scale of the economy has grown, total waste production has grown. Coal use has doubled since 1990, with production over 2 *billion* tons in 2005. Coal burning discharges particulate matter, sulfur

dioxide, and greenhouse gases into the air. Energy consumption, in the form of coal, biomass, and petroleum products, is responsible for most air pollution. At the same time, some efforts to control pollution have begun to have an affect.

20.1.1 Air Pollution

In China's cities today, particularly the larger ones, trends in air quality are shaped by offsetting forces. Air quality has been improved by industrial emission controls and by the shift in household fuel use away from coal. But the growth of industry and the growth of automobile transport are causing an increase in pollutants. The resulting outcomes have differed across cities and specific pollutants.

A major source of improvement in air quality has been the reduction in household use of coal. Until recently even urban households burned coal for heating and cooking, but household use of coal has dropped off dramatically from its peak in 1988. Eighty percent of the urban population now has access to gas for cooking. Indoor air quality in many urban households has improved significantly as gas, electricity, aud central heating have spread. In rural areas, indoor air pollution is still a severe problem. About half of the rural population has unimproved stoves that burn raw coal and wood and produce particulates, sulfur and nitrogen oxides, carbon monoxide, and other pollutants. Iudoor air pollutants contribute to high rates of respiratory disease, the leading cause of death in rural areas and the third-leading cause in cities.

Ambient (outdoor) air quality has improved in many cities, particularly due to the reduction in total suspended particulates (TSP). Despite the increase in the use of coal, the primary source of particulates, TSP concentrations have declined due to controls and change in the way coal is exploited. A much larger proportion of coal is now burned to generate electricity, in larger and better-equipped facilities. Sulfur dioxide emissions have remained roughly constant, however, because sulfur control measures have not been effective enough to offset growing coal use. Ambient concentrations of particulates and sulfur dioxide in many Chinese cities are among the highest in the world and are significantly above World Health Organization (WHO) guidelines and Chinese air quality standards.

The biggest negative impact on air quality has come from the dramatic increase in trucks and automobiles. The total number of vehicles in China soared from 5.5 million in 1990 to 43 million in 2005 (including 11.5 million motorized tricycles and other low-powered vehicles). Motor vehicles emit particulates, sulfur, carbon monoxide, nitrogen oxides, and volatile organic compounds. Lead is an especially pernicious pollutant because of its irreversible

effects on children's intelligence and aptitudes, and China did not eliminate leaded gasoline until 1999. Nitrogen oxides, a major byproduct of the internal combustion engine, have increased steadily since the 1980s. Nitrogen oxides contribute to the formation of ozone, photochemical smog, and greenhouse gas. The European Space Agency recently completed a global mapping project, in which satellite instruments were used to map nitrogen oxide densities for 18 months from 2003–2004. The largest global concentration of nitrogen oxides is the North China Plain, with the area around Beijing in particular standing out. North China now surpasses the northeast United States, where nitrogen oxide emissions are large, but stable (Beirle, Platt, and Wagner 2005). Overall, Chinese cities have become smoggier but less gritty in the past 20 years.

20.1.2 Water Pollution

Since 1980 the quality of China's surface water and groundwater has deteriorated significantly under the pressure of rapid industrial development, brisk population and urban growth, and increased use of chemical fertilizers and pesticides. As a result, water pollution is now a serious problem for urban and rural drinking water. Main sources of pollutants include the following:

Industrial Waste. Pulp and paper, metallurgical, and chemical factories are the worst polluters. Processing of farm products contributes to oxygen-demand pollution, in which water is depleted of oxygen and loses the ability to support healthy plant growth. There has been major progress in cleaning up large-scale factories, and today 90% of industrial wastewater from regulated (large-scale) industries receives some kind of treatment. However, smaller factories, including township and village enterprises, often have no treatment facilities at all.

Municipal Waste. A decade ago almost no municipal sewage was properly treated. A major push has been undertaken to improve sewage treatment, but still only a reported 42% of municipal wastewater was treated in 2003.

Agriculture. Intensively used nitrogen fertilizers and pesticides are a serious source of water pollution. Poor-quality fertilizers, excessive use of nitrogen fertilizers (relative to phosphorous and potassium), and especially widespread use of cheap ammonia bicarbonate fertilizer, which is readily soluble and easily washed out to streams, lakes, and aquifers, add to the impact. Pesticide use, more widespread in recent years, has been implicated in species loss (birds) and has polluted some important water bodies. Animal waste from livestock farms is another major source of biological oxygen-demand and coliform pollution. The ecological balance of Hangzhou Bay is seriously threatened, primarily by agriculture-related runoff, which, according to one study, contributed 88% of chemical oxygen-demand pollution.

As a result of these pollutants, water quality is poor, especially in the water-short northern regions. Table 20.1 summarizes the available data. Water quality below class V means that the water is literally toxic: obviously unsafe for human contact, it is unsuitable even for irrigation, and cannot be safely purified for human uses. In the Liao, Hai, and Huai systems, half the water is in this category, as well as a third of the Yellow River. (See Figure 20.2, which shows these river systems.) These rivers have all three of the biggest pollution problems. Waters turn eutrophic from biological oxygen demand and chemical oxygen demand: depleted of oxygen, waters can only support bacteria and flagellates, and no higher life forms. Persistent heavy metals, such as chromium, mercury, and lead, build up in the water and riverbeds. Chlorinated hydrocarbons (such as PCBs and DDT—banned but still used) build up and are also highly persistent. Class IV waters can be used for industrial and some recreational purposes but is not fit for direct human contact. Class III is the standard for direct human contact, and also for intake into purification for drinking water. Class I is pristine. In northern China the water in only about one-third of the river length meets the standard for human contact. Moreover, this is the entire river system; quality is much worse in the downstream, urban areas where most people live.

Water shortage in the north severely compounds the pollution problem. During dry periods local water-use agencies keep water dammed up to retain water for local users, but in doing so they trap all kinds of pollutants. When the first rains come, gate operators open the dam gates and flush their sections of the river, but in so doing they send a highly polluted waste stream into the main river channel. In recent years authorities have reinforced regional coordination to reduce this problem and ensure continuously flowing (and flushing) rivers. As of 2004 the Yellow River had flowed without interruption for

Table 20.1
Water quality class of main river systems, 2003

	River length (kilometers)	Percentage of total distance in each quality class					
		Class I	Class II	Class III	Class IV	Class V	Below V
National	134,593	5.7	30.7	26.2	10.9	5.8	20.7
Songhua	11,135	0.9	9.2	35.5	32.4	5.2	16.8
Liao	4,529	1.6	8.8	17.6	8.6	13.5	49.9
Hai	10,719	3.1	17.3	18.2	6.1	2.8	52.5
Yellow	13,721	7.6	14.1	11.8	17.7	16.8	32.0
Huai	11,621	2.1	8.8	16.8	15.4	8.0	48.9
Yangtze	38,513	8.9	37.3	31.3	6.4	5.8	10.3
Pearl	16,061	2.0	47.2	25.7	9.2	2.1	13.8

five years, reversing the previous pattern in which the river water would be exhausted most dry seasons. Yet these efforts have not yet produced significant improvemeut in the overall quality of the Yellow River.

The experience in the Huai River basin has been especially alarming. A surge of polluted water on the Huai River in 1994 killed massive numbers of fish, caused widespread illness, and forced municipal and industrial water intakes along the river to shut down. Economy (2004) describes how this event shook up central government leaders and induced them to launch a massive program to clean up the river. Premier Li Peng declared that the Huai would be clean by 2000. Some 60 billion RMB ($7.2 billion) was poured into pollution control in the Huai River over the next decade. However, this expensive program failed utterly to meet its ambitious goals. Indeed, as Table 20.1 shows, the Huai is still one of the most polluted rivers in China. Despite the money made available, local governments protected their local industries and shielded them from costly upgrades or shutdowns. Water quality improvement has been imperceptible.

Southern rivers are less polluted, largely because of the region's more abundant water and the rivers' larger assimilative capacity. Nevertheless, there are many seriously polluted areas. The section of the upper Yangtze River near Chongqing was fouud in 1993 to have failed NEPA standards for chemical oxygen demand, chromium, mercury, lead, ammonia nitrogen, petroleum, acidity, and coliform. One of the worries associated with the Three Gorges Dam is that it will trap pollutants around the densely populated Chongqing area.

20.1.3 Costs of Pollution

Air and water pollution damages the health of people exposed to it, lowers the productivity of workers, and degrades natural resources. What are the costs of these damages, and which damages should worry Chinese policy-makers the most? A number of studies have attempted to quantify the costs of pollution to the Chinese economy, without achieving much consensus.

World Bank (1997) was an ambitious attempt to calculate the costs of pollution in China. According to this study, total air and water pollution costs were estimated at $54 billion a year, or roughly 8% of GDP. These costs do not make the growth rate lower or less meaningful; instead, they are ongoing costs that reduce the well-being of China's population in every year. The largest losses were due to

- Health losses associated with urban air pollution—particularly debilitating chronic bronchitis

- Health losses associated with indoor air pollution
- Chronic disease from water pollution—especially heavy metals and toxins
- Crop and forestry damage from acid rain
- Nervous system damage and reduced intelligence among children exposed to high levels of lead.

The study calculated that the total health and productivity losses associated with urban air pollution, including hospital and emergency room visits, lost work days, and the debilitating effects of chronic bronchitis, cost more than $20 billion a year, making them the single largest pollution cost in China today. It would be possible to avoid 178,000 premature deaths each year if China met its own class II air pollution standards, and 4.5 million person-years are lost because of illnesses associated with urban air pollution levels that exceed standards. Estimates based on conservative assumptions about indoor air pollution suggest that it causes 111,000 premature deaths a year. The health problems caused by indoor fuel use are on a scale roughly comparable to that posed by smoking. Water pollution damages human health, fisheries, and agriculture (from polluted irrigation water) and increases spending on clean water supplies. Improvements in water supply and sanitation can substantially reduce the incidence and severity of diseases, such as hepatitis, as well as the infant mortality associated with diarrhea. Surprisingly, though, water-related diseases are less common in China than in other developing countries, and they appear to be a less significant cost than respiratory diseases plausibly related to air pollution. There are other hidden costs to pollution. For example, China is estimated to have at least 5,000 so-called brownfields—chemical- or solid-waste dump sites. Virtually none of these have been cleaned up, and little is known about the potential costs.

20.1.4. Pollution Control

China put into place a significant pollution-control effort during the course of the 1980s. The resources actually flowing into that effort, stepped up considerably after 1997–1998, when the combination of government reorganization (which made SEPA into a national ministerial-level organization) and a series of environment-linked disasters, including flooding on the Yangtze, increased the priority given to the environment. Overall, Chinese official data indicate that 1.4% of GDP went into investment in pollution control in 2003, a substantial sum. The bulk of this went for urban infrastructure, with water and sewage the largest chunk, followed by greenification. Lesser amounts go to abate industrial pollution and fit new factories with pollution control equipment (Environmental Statistics 2004, 7, 96).

China was an early adopter of a system of fees for discharges of pollutants. That system has generated a steadily increasing flow of funds that are earmarked for pollution abatement. The total sum surpassed 6 billion RMB (about $750 million) in 2002. Pollution fees have some obvious benefits, since they encourage firms to find least-cost methods to improve their environmental performance. Chinese fees have been criticized, however. Fees are frequently rebated to the polluting firm in order to fund investment in pollution abatement, but oversight of actual spending is weak. Corruption and diversion of fees have been a problem in some areas—moreover, local environmental officials actually have an incentive to keep polluters polluting, since allowing these practices to continue generates revenues for them. Nevertheless, some important achievements have been made. Generally speaking, the abatement of industrial wastes from large factories has been a relatively positive part of China's environmental policy. According to SEPA (2004), total wastes have stabilized even as industrial output has grown sharply. Total industrial pollution of water, as measured by chemical oxygen demand, has declined somewhat. Industrial heavy-metal pollution has declined very significantly since 1997, and discharge of petroleum products has been significantly reduced. If maintained, these are significant achievements.

20.2 SUSTAINABILITY

Not all environmental problems can be traced to pollution, nor can they be appropriately evaluated in terms of their current costs or expressed as a percent of GDP. Critical environmental problems in China relate to the coordination of enormous demands on China's natural resources. These problems are more difficult to quantify because a large but unknown share of costs are deferred to the future. There are no markets that reflect the true costs of activities. In some cases, designing such markets would be difficult or impossible. In other cases, because China is a transitional and a developing economy, markets are simply incomplete. There is a significant danger that slowly increasing costs might suddenly reach a "tipping point": Rather than increasing in a linear relation with demands on resources, costs may increase qualitatively once the level of "carrying capacity" of an environment is reached.

20.2.1 Broad Impact of Pollution and Global Warming

As China's economy has become large, the implications of Chinese pollution and resource use have also grown. Air pollution, for example, has regional and global consequences. When fossil fuels are burned, oxides of sulfur and

nitrogen combine with other chemicals in the air to form sulfuric acid and nitric acid, which precipitate as acid rain. These gaseous emissions can stay in the atmosphere for several days and travel hundreds or thousands of kilometers before falling back to the earth's surface as acid rain. Acidity is highest in southern China, particularly in Sichuan, Guizhou, Guangxi, and Hunan, both because of extensive use of high-sulfur coal and because of naturally acidic soils.

China is a significant contributor to the problem of global warming. China is the second-largest source of greenhouse gases, after the United States, and its carbon emissions are growing rapidly. By most estimates, China accounts for about 15% of global carbon emissions, compared to 23% for the United States. As described in Chapter 14, the breakdown of Chinese statistical reporting led to a significant underestimate of coal use at the end of the 1990s, which led to excessive optimism about China's ability to limit carbon emissions. We now know that total carbon emissions have continued to grow. Assuming that Chinese statistics for 2005 accurately measure total coal production, as seems likely, then China's production of coal energy—and thus carbon emissions—have been growing since 1996 somewhat *faster* than they were growing before 1996, at 5.1% annually compared to 4.6%. At this growth rate, China will catch up with the United States and become the largest single contributor of carbon dioxide emissions some time between 2015 and 2020.

There is significant debate about China's role in a global climate-control regime. In the Kyoto Treaty, developing countries including China and India are not required to control their carbon emissions. Critics of the treaty argue that no global regime can be meaningful without Chinese and Indian participation. Chinese policy-makers have argued, in the general spirit of the environmental Kuznets curve, that development should come first, and that developing countries should be unconstrained during the development process, deferring their contribution to this global public good until a later date. They also point out that even when Chinese carbon emissions catch up with those of the United States, per capita carbon emissions will only be one-quarter the level of the United States. In the middle ground are those who point out that China, since it contains pockets of extremely backward technique, presents opportunities for reduction of carbon emission at potentially extremely low cost. An international regime that would create incentives for China to abate, either through tradable emissions credits or through alternative mechanisms, would be in the interests of all parties.

China continues to be a relatively energy-intensive economy. As described in Chapter 14, China in 2002 required about 0.23 kilograms of oil equivalent to produce one dollar of PPP-adjusted GDP. That figure compares to about

0.15–0.25 kilograms for a number of large lower- and middle-income industrializing countries. China's energy efficiency is likely to continue to improve, since over the past 25 years China has been steadily reducing the amount of energy input required to produce a given value of GDP. There are still many opportunities to improve energy efficiency. However, it is likely that China will remain a comparatively energy-intensive economy. The fundamental problem is China's enormous dependence on coal for power generation (Chapter 14). Coal is cheap to burn, but much more expensive to burn cleanly. Some areas of coastal China will shift to imported petroleum products, and there is scope for alternative and less-polluting techniques. However, most parts of China will continue to be dependent on coal for the foreseeable future. Improvement, therefore, must rely on a combination of more-efficient coal use (especially through concentration in larger and cleaner electricity-generation facilities) combined with larger investments in pollution-control equipment. In addition, the fact that China has such an extraordinarily large share of its total output in industry (Chapter 6) also inevitably implies higher energy use per unit of GDP. Industries such as steel, cement, and chemicals are by far the largest users of energy in an economy. It seems inevitable that Chinese greenhouse gas emissions will continue to grow and eventually make China the largest single contributor to global warming. In the meantime, global warming is already a reality.

20.2.2 Sustainability of Land and Water Resources

Further broad issues of sustainability relate to the intertwined questions of sustainability of land and water resources. Since China has virtually no unexploited potentially arable land, any reductions in existing farmland must be viewed very seriously. At the same time, the productivity and value of existing (and remaining) farm land has been increasing. Simple land availability is unlikely to be the major obstacle to agricultural output or food availability. In addition to conversion of agricultural land to nonagricultural uses (housing, roads, and factories), degradation of farm land is a substantial cause of the reduction in farmland. Pollution is siguificaut, but by no means the most important factor. Rather, issues relating to appropriate water supply dominate the problem of land degradation. Too much water in the wrong times and places causes erosion, and too little causes desertification (Table 20.2). Erosion is concentrated in western regions of China, where overall water supply is deficient, ground cover is sparse, and seasonal rainfall causes huge soil losses due to erosion. Serious flooding on the Yangtze in 1998 was directly liuked to the degradation of the upstream environment due to deforestation and erosion.

Table 20.2
Major causes of arable land degradation

	Percent of total
Erosion	48
Desertification	18
Salinization and waterlogging	7
Pollution	12

20.2.2.1 Desertification

Desertification is an enormous problem. China, as stressed in Chapter 1, is an arid country. West of the Aihui–Tengchong line much of the land is desert. However, the desert has been moving east, primarily because of the impact of human activity in China. The overexploitation of grass and forest lands has greatly reduced the regenerative capacity of the land's plant cover. With weakened biological buffer zones, deserts have spread significantly. The State Forestry Administration did large-scale surveys of desert areas in 1994 and 1999, and discovered that deserts had grown by 52,000 square kilometers in just that five-year period. One of the most dramatic results has been an increased frequency of sand and dust storms. In March 2002, two huge dust storms blew across northern China, reducing visibility for days and pushing airborne particulate matter over the top of all measurement scales in Beijing. These storms blew clouds of dust beyond China, affecting Korea and Japan, causing school closings, and coating some cities with a thin layer of dust.

The single most important factor aggravating desertification in recent years has been overgrazing in the grasslands of Inner Mongolia and other pastoral regions of northern China. The dissolution of the collectives in these areas led to the distribution of herds of grazing animals to individual households and an explosion in the size of herds. The "tragedy of the commons" was exacerbated as each individual household sought to maximize its own individual income from animal husbandry. Vast areas of China are classified as grasslands: over 40% of the entire land area. The impact of intensified exploitation on marginal grasslands on the edge of the desert has been catastrophic in some areas. Chinese policy has recognized the danger of desertification for more than 20 years, but policies have not been sufficient to arrest the advance of the deserts. "Shelter belts" of planted trees seek to halt the encroaching desert. Indeed, the expansion of the desert during 1994–1999 came despite the successful rehabilitation of 5,700 square kilometers through reforestation, grass seeding, and expanded irrigation. Most of the rehabilitation took place in central China, in areas not too distant from major watercourses. Most of the

spread of the desert took place in northern China, especially in the vast border areas populated by herders.

20.2.2.2 Forests and Grasslands

Away from the frontiers of expanding deserts, the efficacy of Chinese sustainability policy has been substantially better. For many years tree planting has been emphasized as a government policy, as a civic responsibility, and, on several occasions, as a campaign of mass mobilization. Over the long term this consistent emphasis has had a significant payoff, and China's overall forest cover has grown substantially over the past 40 years. The sixth national inventory of forest resources, over the 1999–2003 period, found that forest cover had grown to 18.2% of the national territory (175 million hectares), up substantially even from the 16.6% in the previous (1994–1998) inventory. Indeed, the lowest forest cover was found in the first such national inventory, in 1962, which found that only 8.9% of China was forested (Roumasset, Wang, and Burnett 2004). But these statistics obscure a substantial deterioration in the quality of forestland. The newly planted forest cover tends to be composed of a relatively small number of fast-growing species, scattered through densely settled parts of China. At the same time, considerable acreage of old-growth forest, with diverse species and big trees, has been lost. In 1998, Chinese policy-makers prohibited logging in a broad swath of forests in Southwest China. They were reacting with alarm to devastating floods of the Yangtze that were linked to erosion and deforestation in the upstream reaches of the river. This drastic measure slowed the exploitation of China's largest remaining natural forests. However, in the long run, protection of these forests depends on further developing a system of property rights, rules, and rewards that give local residents incentives to protect forestlands.

Since the turn of the millennium the Chinese government has encouraged the conversion of marginal farmlands to forest or grassland through a variety of programs. The most important program is "grain for green," which provides farmers compensation for five to eight years when land is converted from grain farming to forest or pasturage, while also allowing the farmer to maintain ownership of the land. Pilot implementation began in three western provinces of Sichuau, Shaanxi, and Gansu in October 1999, and farmers in those provinces removed a total of 1.24 million hectares from grain production through the end of 2001. Nationwide, the amount taken out of agriculture in this way was over 2 million hectares in 2002 and 2003, before dropping to only 733,000 hectares in 2004 (because of higher farm prices and less enthusiastic implementation). Altogether, this program has takeu almost 5% of China's cropland out of production, providing a recuperative opportunity for a significant area of China's marginal lands.

20.2.2.3 Water Availability

The interplay of land and water resources is also shown by the fact that irrigation remains by far the biggest human use of water in China, accounting for two-thirds of total water use, although the proportion is slowly declining. Particularly troubling is the fact that to date China has been forced to rely on numerous unsustainable practices to maintain current supplies of water to its cities and agriculture. We have already referred to the intense demands on the rivers of northern China and the intense pollution that already afflicts them. A related serious problem is the overexploitation of groundwater. Using underground water supplies (aquifers and ground water) in such a way that they are gradually depleted is sometimes known as "mining water." This is a very serious problem in northern China (Cheng 2002, 52–63). Large amounts of water have been withdrawn from underground sources beginning in the 1970s for tube-well irrigation in the North China Plain. The water table underneath Beijing fell from only five meters below the surface in 1950 to 50 meters in 1994. It has become more difficult and costly to extract water from these underground sources. Private entrepreneurs now dig deep wells and sell the water, increasing supply but increasing the long-run threat to the sustainability of water supply. The problem is most severe with respect to wheat, which requires water outside the normal rainy season and is thus dependent on irrigation (Lohmar and Wang 2002). Conceivably, the North China Plain might stop growing wheat if food prices stay low and water costs continue to rise.

Cities have been extracting increasing amounts of water. As a result, many cities are now experiencing difficulties extracting water, as well as subsidence of land. Coastal cities including Tianjin and Shanghai have experienced major subsidence problems. Depleted aquifers allow saltwater to intrude into water sources near the coast, requiring the abandonment of thousands of wells. These are very serious problems, and solving them will be expensive. Efficiency improvements are possible at nearly every point in the chain of collecting, storing, and delivering water. Currently, charges to farmers for irrigation water cover an estimated 36% of the cost of supplying the water (Lohmar et al. 2003). Higher prices would help economize on water and shift it toward higher-value nonagricultural uses. However, there is no guarantee that effective measures will be adopted in a timely fashion. China's agriculture is so small-scale, with more than 200 million farms, that charging for volume of water delivered is costly and probably inefficient. Problems with water availability may be compounded by deteriorating dams and irrigation facilities. Many of the facilities in the most populous and prosperous parts of China were constructed in the 1950s. Some are made of earth or brick; they are heavily silted, and need

repair and upgrading urgently. According to Nickum, "The primary pressure on irrigated area now, and probably for some time into the future, is project obsolescence within the irrigation sector itself" (1998, 890).

These concerns will probably require larger government investments in water management facilities. In northern cities, the past pattern has been overexploitation of rivers and surface reservoirs, followed by overuse of underground water resources, and finally recourse to long-distance water transfer (Smil 2003, 157). One major initiative, tentatively approved by the Chinese government, is to pump southern water northward to alleviate stress in the North China basin. There are three feasible routes (Figure 20.2). The western route is most expensive but might provide the best water quality; the eastern route is cheapest but provides the lowest water quality. The middle route may be the best compromise, and preparatory construction work is underway. Eventually, the middle route would be connected to the reservoir on the

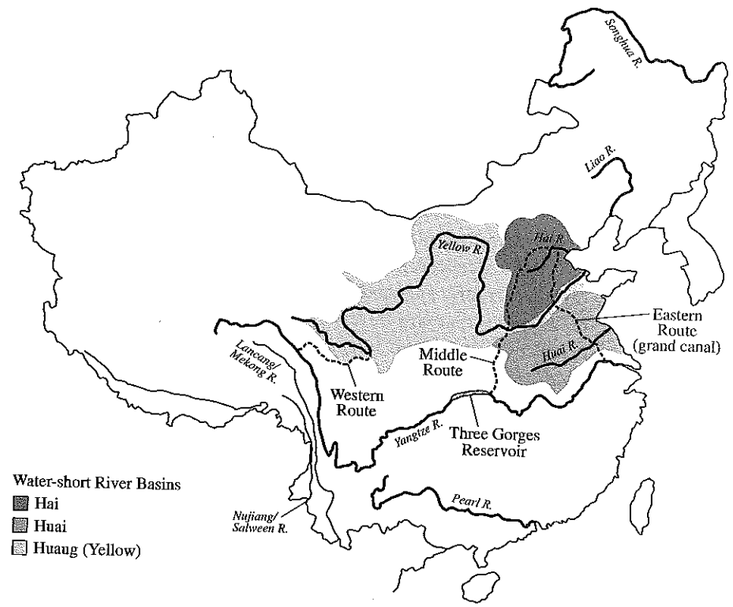

Figure 20.2
South–north water-transfer routes

Yangtze above the Three Gorges Dam. A large volume of water could then be transported north, about twice as much as is shipped to California from the Colorado River in the United States. These grand infrastructure projects are expensive and, in the long run, less important than the hundreds of thousands of small-scale improvements in the efficiency with which water is used, as delivery systems are upgraded, and consumers are given stronger incentives to conserve water.

20.3 CONCLUSION

Environmental degradation has imposed serious costs on the Chinese economy and reduced the well-being of the Chinese population. Moreover, there is increasing public concern about environmental issues, and that concern has increasingly been publicly articulated. A milestone of sorts was reached in February 2004, when Premier Wen Jiabao suspended work on a series of dams projected for the Nujiang (Nu River or Salween) in Yunnan. This river flows through a beautiful, rugged area where the upper reaches of three great rivers (the Yangtze, Mekong, and Salween) flow in parallel less than one hundred kilometers apart. It is naturally an area of enormous biodiversity, as well as being the home of several different ethnic groups living in these remote highlands along the border with Myanmar. The release of plans for a cascade of dams along this river triggered significant protests within China, as well as abroad. The government's responsiveness to these protests will be a bellwether of its willingness to let public opinion serve as an input into economic decision-making.

China is currently engaged in a large-scale program of dam building to generate electricity that will be essential if China is to restrain the growth of its fossil fuel use. By far the largest part of China's hydropower potential is in the Southwest. The case of the Nujiang thus represents an ongoing conflict between the needs of economic growth and the obligation to protect biological and human diversity. To navigate this conflict, China will urgently require public input and discussion in the decision-making process. China already has requirements for environmental impact statements: if such statements are to fulfill their potential role, they must be available for public inspection and comment, which has not often been the case in China. The case of Nujiang thus provides an ideal opportunity to give environmental impact statements their proper role. This kind of role for pnblic opinion is also indispensable if something like the environmental Kuznets curve is to prove a reality in China. Perhaps environmental quality is a luxury good, and demand for it increases

more than proportionately as income grows. Even so, if citizens have no way to convert their preferences into effective demand and command over society's resources, it is hard to see a consistent motive force behind environmental improvement.

The challenges of water availability, resilience of the natural environment, and atmospheric degradation and climate change are among the most serious that China confronts. In each case it is easy to see that current practices are unsustainable, but it is hard to project when the obvious costs that these practices impose will force serious change. There is still an opportunity for improved environmental policy-making to make a significant difference before further environmental catastrophes develop.

In its most recent planning exercise, the five-year plan for 2006–2010, the Chinese government called for a reorientation of the economic growth model toward a sustainable growth with a lighter environmental impact. By itself, of course, mere adherence to a particular approach to development planning will not dramatically change the quality of China's environment, no matter how friendly to the environment it is proclaimed to be. But this shift in viewpoint suggests that government policy might slowly begin to become one positive element in the complex mix of factors that determine China's environmental trajectory. In combination with many other social, technological, and economic factors, that could turn China in the direction of gradual environmental improvement.

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Smil (2003) collects his original pioneering work on the Chinese environment, along with a retrospective reassessment. Though the shifts in time perspective are occasionally bewildering, overall it is an astonishingly rich and stimulating volume that effectively demonstrates the author's prescience.

SEPA, the State Environmental Protection Agency, has a good English-language Web site, http://www.sepa.gov.cn/english/, with annual reports on the environment posted. There are also daily air pollution readings from more than 80 Chinese cities.

An excellent online bulletin on China's environment is put out by the U.S. embassy in Beijing. See the Beijing Environment, Science, and Technology Update at http://www.usembassy-china.org.cn/sandt/estnews020802.htm. The discussion in the chapter on desertification drew on the issues of February 8, and March 29, 2002. Estimate of funds spent to clean up the Huai River from issue of June 30, 2004.

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Figure 20.2: Map of south–north water transfer routes. Liu (1998, 902).

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