1. Introduction: economic growth and the environment

1 INTRODUCTION

Market transition reforms in China have been shaped by the interaction of a number of factors, including economic conditions, political constraints and official ideology. During this process, transitional institutions took some unconventional forms. However, although these transitions were second-best arrangements, the incentives of economic agents were generally improved. The consequences of this reform process were generally comprehensive, consistent and deep, and this helps to explain why the reform process was more successful in China, as against Eastern Europe, in the period up to 1990. The relation between institutional changes, economic performance and economic conditions are clearly interconnected as the cycle continues and reform moves forward.

China is clearly an economic powerhouse with average economic growth of close to 9 percent per annum over the last 25 years (World Bank, 2001). However, as a result of China’s extremely rapid economic growth, the scale and seriousness of its environmental problems are clearly evident. Consequently, a number of environmental problems, including growing energy consumption, heavy reliance on coal and increasing air pollution, are threatening China’s sustainable future. For example, the World Bank estimated that economic damage caused by pollution in China cost around $54 billion annually, amounting to close to 8 percent of gross domestic product (GDP) (World Bank, 1997a). Similarly, Economy (2004) reported that in 2000, China had 16 of the 20 most polluted cities in the world, and Bolt et al. (2001) concluded that China’s air pollution problem is the world’s worst. By the end of the twentieth century, the explosion in economic growth also made China the world’s second-largest carbon dioxide (CO₂) emitter and energy consumer after the United States.

In response, from the late 1970s, China began implementing a number of environmental policies in relation to air and water pollution and solid waste disposal, and the number of these regulations has been steadily increasing (Sinkule and Ortolano, 1995). The State Environmental Protection Administration (SEPA) has also declared control of industrial
pollution to be a top priority for Chinese regulators. Responding to this severe environmental pollution, the National Environmental Protection Agency (NEPA) and the State Planning Commission (SPC) jointly proposed China’s Environmental Action Plan for 1991–2000. The plan highlights the environmental issues that officials at the national level consider particularly significant. The top three (of seven) problems listed deal with water pollution, air pollution and hazardous waste. The next three involve conservation of natural resources in the form of water, land, and forests and grasslands. The final problem centers on the balance and integrity of China’s ecosystems (Ma and Ortolano, 2000). However, weak enforcement of environmental regulations has been recognized as a major problem in China. This chapter reviews the background of economic and environmental policy and conditions.

2 ECONOMIC GROWTH IN CHINA

Reform in the Government System

By 1978, China was one of the most closed economies in the world. The Chinese economy had been closed to Western countries since 1949, and it had been closed to the Eastern bloc since the early 1960s following conflict with the Soviet bloc. The fiscal system as a whole before reform was quite centralized. This is because the SPC had the authority to determine local revenue and expenditure plans on an annual basis, although some fiscal decentralization was implemented. This was known as the principle of ‘unified revenue and unified expenditure’. This meant that all government revenue and expenditures had to be directed through the central government.

In December 1978, the Third Plenum of the Eleventh Chinese Communist Party Congress was held. This event is widely regarded as the beginning of the reform era. The main achievement of the meeting was the decision to shift the Communist Party’s focus from ‘class struggle’ to ‘economic development’. An intensive ideological debate between Mao Zedong’s orthodox version of Marxism–Leninism and pragmatism preceded this meeting in mid-1978.

In 1979, the government decided to welcome foreign investment and expand foreign trade. This allowed a change in ideology from within the Communist Party and paved the way for the initialization of reform. The accepted ideology during the first phase of reform was the idea of ‘planning as a principal part and market as a supplementary part’. This was a significant change from Mao’s ideology of abolishing markets.
As a result of these reforms, there was a significant improvement in people's standard of living. The state sector was no longer the dominant part of the economy, and most of the old revolutionaries disappeared from the political scene. In 1980, a major fiscal reform began, involving central and provincial relationships. This reform, known as the ‘fiscal contracting system’, was colloquially referred to as ‘eating from separate kitchens’. Under this system, budgetary revenue was divided first into ‘central fixed revenue’, which was remitted to the center, and then into ‘local revenue’, which was shared. The contractual sharing rates varied from province to province.

**Origin of Growth**

Before the reform, China was poor, overpopulated, short of human capital and natural resources, and centrally planned. After more than two decades of market transition, it progressed into a lower-middle-income, emerging market economy. During this period, China’s per capita GDP more than quadrupled, and total GDP grew at an average annual rate of more than 9 percent. In the early 1980s, few economists would have expected the outcomes seen in China today. This growth is also likely to continue for the foreseeable future. Figure 1.1 presents the GDP growth of several major regions, including China, the European Monetary Union...
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(EMU), Japan and the United States. Clearly, the speed of growth in China is much higher than these other regions. For example, the growth rate in China is around three times higher than that in the USA over the past five years. Even when considered as a developing economy, its more than US$1.3 trillion economy in 2003 is bigger than all other transition economies combined. In 2004, however, GDP in China was still only 13, 22 and 28 percent of GDP in the USA, the EMU and Japan, respectively (see Figure 1.2). However, in GDP dollars expressed in purchasing power parity (PPP) terms (shown in Figure 1.3), putting aside the limitations of GDP conversion at market exchange rates, China surpassed Japan in 1995 and is close to the EMU. China also has a population almost three times the combined size of the eight highest-performing East Asian economies (Japan, South Korea, Taiwan, Hong Kong, Singapore, Malaysia, Thailand and Indonesia).

Conventional economics suggests a basic recipe for transition from a planned to a market economy. This entails stabilization, liberalization and privatization following political democratization. To guarantee sound reforms, this recipe may not be sufficient, but theoretically these essential ingredients are necessary for reform to succeed. Although many of its policies, such as being open to trade and foreign investment, and attention to macroeconomic stability, have been adopted by the government, violations of these standard prescriptions are clear. For the most part, China’s reforms in the last two decades succeeded without complete liberalization, privatization and democratization. Therefore, the Chinese path of reform

Figure 1.2  Gross domestic product

Source: WDI (2005).
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and its associated rapid growth is puzzling because it appears to defy conventional wisdom. Blanchard and Fischer (1993), for example, have questioned why China has grown so fast when the conditions thought to be necessary for growth are absent.

Several plausible explanations are provided in the literature. One aspect concerns alternative financing and governance mechanisms. One of the most important of these mechanisms is reputation and relationships (see Allen et al., 2005). This literature indicates that traders’ organizations in the eleventh century were able to overcome problems of asymmetric information and the lack of legal and contract enforcement mechanisms (Greif, 1989, 1993). This is because they developed institutions based on reputation, implicit contractual relations and coalitions. China’s private sector closely resembles certain aspects of these traders’ organizations, especially in terms of how firms raise funds and contract with investors and business partners. Greif (1994) and Stulz and Williamson (2003) have also pointed out the importance of cultural and religious beliefs to the development of institutions, legal origins and investor protections.

The second most important mechanism is competition in product and input markets (see Allen et al., 2005). This mechanism has been shown to work well in both developed and developing countries (for example, McMillan, 1995; Allen and Gale, 2000; Allen et al., 2005). For example, Allen et al. showed how firms in the private sector raise funds, their various growth paths, and the alternative mechanisms employed by owners that can substitute for formal corporate governance mechanisms. Their survey

Source: WDI (2005).

Figure 1.3 GDP dollar estimates derived from PPP calculations

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included private sector firms in Wenzhou, a city in Zhejiang province. The survey suggested that it was only those firms that had the strongest comparative advantage in an industry (in the area) that survived and thrived. See also Djankov et al. (2002), which examines entry barriers in 85 countries, including China.

The third mechanism is local government’s fiscal incentives (Qian, 2003). China has been viewed as supporting local development and helping local businesses. Specifically, the planning system has been decentralized along regional lines, and local governments have played an important role in economic decision making and resource allocation. Decentralization led to the rise of many small-scale SOEs financed from local government revenues. In addition, they induced collective enterprises, such as commune and brigade enterprises in rural areas, predecessors of township–village enterprises, to emerge outside the state plan before the advent of reform.

Jin et al. (2005) have used panel data on 28 provinces between 1982 and 1992 for local government revenues and expenditures to evaluate the marginal fiscal incentives of provincial governments. They conclude that the new fiscal system did indeed substantially enhance the fiscal incentives for local governments. These results are in contrast to the Russian experience, where increases in a city’s own revenue were almost entirely offset by a decrease in shared revenue from the region to the city (Zhuravskaya, 2000).

Incentive theory argues that local government does not have an incentive to support productive local businesses if the central government subtracts all of the locally generated revenue, because it cannot benefit from their support. Conversely, if local government expenditures are closely linked to the revenue they generate, the local governments will more likely support productive local businesses as they benefit directly from their support. The empirical evidence found by Jin et al. (2005) reveals that such incentive effects do exist and are significant. An increase in the marginal fiscal revenue retention rate in a province by 10 percentage points is associated with an increase of one percentage point in the growth rate of employment by nonstate enterprises in that province.

Productivity Growth

The empirical literature on economic growth in China suggests that total factor productivity (TFP) growth has played an important role in increasing GDP during the reform period (for example, World Bank, 1997a; Maddison, 1998). However, there is little consensus on the results in more recent years, that is, economic growth during the 1990s has followed a different pattern from that in the 1980s. For example, Liu (2000) believes that most of the productivity gains in the past two decades stemmed from the
rectification of resource misallocations that were the legacy of the central planning era, and from narrowing the technology gap between China and the developed economies. Over time, as China moves closer to a market economy, such gains will inevitably diminish.

In addition, several economists have raised questions regarding the origin of economic growth in China. For instance, Krugman (1994), citing work by Young (1994, 1995), has argued that rapid growth in the East Asian newly industrialized countries (NICs) has been driven mainly by the massive injection of factor inputs, rather than innovation. As China’s growth is likened to the East Asian NICs, the same argument is made about the Chinese economy. If this argument is true for China, growth is not sustainable. Sachs and Woo (1997) also pointed out that China’s broad growth performance is in line with the performance of other East Asian economies and is attributable mainly to factor accumulation. Characteristics similar to those of other East Asian economies include low initial capital endowment, access to international sea lanes, an export orientation strategy, and a high proportion of the labor force in agriculture. They also find that economic reform has not improved SOE performance, as based on declining profitability, and SOEs have actually become a destabilizer for the economy as a whole (ibid.).

Input-driven growth, such as capital-oriented growth, is also not sustainable in the long term because of diminishing returns to capital. This leaves productivity as the only viable engine of long-term economic growth (Liu, 2000). Young (2000) questions the performance of China’s growth by linking his findings on the convergence of the provincial industrial structure to the fragmentation of the domestic market and the distortion of regional production away from patterns of comparative advantage. Young (2003) also shows that one can reduce the growth rate during the reform period to levels previously experienced by other rapidly growing economies, so that TFP growth in the nonagricultural economy is found to be about 1.4 percent per year – a respectable performance, but by no means extraordinary.

In the literature on China’s productivity, several studies apply a growth-accounting approach to examine the role of productivity in China’s economic growth. For example, by employing Robert Solow’s residual growth accounting method, Borensztein and Ostry (1996) and Hu and Khan (1997) found a significant contribution of TFP to growth during the reform period. However, the growth accounting method should be treated with caution since it suffers from some major drawbacks. The method requires the assumption of constant returns to scale, revenue maximization, and the assumption that all decision-making units are efficient, and requires information on cost and/or input and output price data that is often unavailable.
The second assumption especially is questionable when producers’ objectives differ, or are unknown or unachieved. The third assumption is crucial if there are situations in which prices are distorted or nonexistent. Finally, and most importantly, the growth-accounting method cannot distinguish between technological progress and changes in technical efficiency.

In this study, we use an alternative technique to overcome these problems. We apply a mathematical programming technique called ‘nonparametric frontier analysis’ or ‘data envelopment analysis’ (DEA) (see, for example, Färe et al., 1994) to compute the change in productivity over time. This study decomposes TFP change to provide a better understanding of the relative importance of various components over the study period. The TFP includes all categories of productivity change, which can be decomposed into two components including technological change and efficiency change (ibid.).

Technological change (TC) and efficiency change (EC) have additive or multiple relationships in the composition of TFP. It is then important to analyze these two conceptually different measurements considering the effects of economic reform. TC measures shifts in the production frontier or measures productivity growth by stimulating innovation. EC measures changes in the position of a production unit relative to the frontier – so-called ‘catching up’. If existing resources are not fully utilized in production before reform, we can expect a significant increase in EC. Understanding these two components of productivity change is important since it provides valuable insights into understanding the source of a country’s spectacular growth. Furthermore, distinction between these two effects provides insights for future growth such that the effect of technological change can be large and sustainable while the effects of efficiency change can be drawn out over time (Lucas, 1988).

The most recent study analyzing productivity in China is provided by Wu (2003), who found that TFP has on average contributed to 13.5 percent of economic growth during the 1981–1997 period using economy-wide province-level data, including the agricultural sector. Wu also found that this contribution is mainly due to technological progress, which tends to accelerate over time. Efficiency change has also been very volatile, reflecting the uncertainties associated with economic reforms and transition (see Figure 1.4). TFP growth was found to be 1.41 percent on average, which has been used to question Chinese growth performance. Significant improvements in productivity are found to appear in the early 1980s; that is, in the years after initiation of the reforms. This is consistent with reforms that began in the agricultural sector in the late 1970s and the success of rural reforms (Lin, 1992).

On the other hand, poor performance is suggested in the second half of
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Efficiency declined every year except 1988 during the 1986–1991 period. The decline in efficiency may well have occurred in many economic sectors during this period. The poorest performances are in the agricultural, industrial and nonstate sectors, including township, village and private enterprises, and these have been well analyzed in the literature (see Kalirajan et al., 1996; Jefferson et al., 1992; Fong and Tong, 1998, respectively). Finally, all three indicators have shown an upward tendency during the early 1990s. This may be the result of reforms initiated in the mid-1980s and more comprehensive reforms implemented in the early 1990s. In particular, price deregulation, which removed price distortions during the early 1990s, created a better business environment for both domestic and foreign investors.

On this basis, Wu (2003) suggests that China’s growth will be sustainable in the near future and concludes, unlike Krugman (1994), that productivity increases contributed to economic growth. However, it should be noted that the contribution of productivity increases to economic growth is relatively small compared to that in developed countries or even some developing countries. Economic development in China still clearly depends on the massive injection of factor inputs. For example, Dougherty and Jorgenson (1996) estimate that productivity accounted for 26.2, 49.8 and 57.6 percent of output growth during the 1960–89 period in the United States, Japan and Germany, respectively. These figures are much higher than the Chinese equivalent of 13.5 percent. Chang and Luh (2000) analyze data from 10

![Figure 1.4: Total factor productivity, technological change and efficiency change](image-url)


Figure 1.4 Total factor productivity, technological change and efficiency change
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Asian economies, including China, Japan, the NICs and the ASEAN-4, using distance-function-based Malmquist productivity indices following Färe et al. (1994). Compared with the other countries, they find that China exhibited productivity regress in both the 1970s and the 1980s. It is thus clear that there is ample scope for improvement in productivity performance in China. Our study evaluates more recent growth, focusing on the industrial sector and using a more sophisticated technique.

3 INSTITUTIONAL DEVELOPMENT OF ENVIRONMENTAL POLICY IN CHINA

Decision-making System of Environmental Policy

As a result of China’s rapid economic growth, degradation of the environment has become increasingly severe over the last two decades. For example, the World Bank estimated that economic damage caused by pollution in China cost around $54 billion annually, amounting to close to 8 percent of domestic GDP (World Bank, 1997a). During the 1990s and early 2000s, some mega-cities, including Beijing, Shenyang, Xian, Shanghai and Guangzhou, have always been included among the 10 most polluted cities in the world. Urban pollution in China has also caused significant public health and economic damage. To protect public health and environmental quality, the government has undertaken a series of actions, and various laws, regulations and standards have been promulgated (Sinkule and Ortolano, 1995; Edmonds, 2004).

The decision-making system of environmental policy consists chiefly of three organizations. First, the National People’s Congress (NPC) has a committee responsible for environmental policy, called the Environment and Resources Protection Committee (ERPC). The NPC makes policy decisions for environmental protection, passes legislation, and supervises its enforcement. Second, the State Environmental Protection Commission (SEPC) of the State Council drafts policies, regulations and laws for environmental protection. Third, the SEPA administers and supervises the environmental protection laws throughout the country. The local environmental protection bureaus (EPBs) and environmental protection offices (EPOs) at the province, municipality and city levels are directly under the SEPA. EPBs and EPOs are raised to first-tier status under local governments because of the upgrade of the SEPA. The chief responsibility of the EPBs and EPOs is to enforce laws, implement policies and assist in drafting local regulations to supplement central organization. Therefore, EPBs and EPOs work directly with local factories, other polluters and
industrial bureaus’ local government actors. The industrial bureaus’ local government actors include planning commissions, economic commissions, the People’s Congress and mayors.

Radical reform of government administration was conducted by the Ninth National People’s Congress in 1998 when the environmental protection agency was upgraded to ministerial status and renamed as the SEPA. During this reform period, the number of government ministry-level organizations was reduced from 40 to 29. Around 50 percent of government employees were slated for elimination from the government payroll (Eckholm, 1998). The emergence of the environmental protection administration was an exception during this massive effort to cut central government administration. Whether the administrative reforms of the 1998 Ninth National People’s Congress actually changed the performance of environmental management in China is an empirical question.

Before the 1998 administrative reforms, industrial ministries, such as the Ministry of Chemical Industry, were responsible for industry-specific environmental management. They developed their own monitoring stations for specific types of pollution as well as sector-specific environmental regulations to supplement national regulations. After the 1998 reforms, many ministries were abolished, and several were recreated as bureaus under the State Economic and Trade Commission (SETC).

Actual implementation of regulation, at least in part, has depended on the effectiveness of the monitoring system and incentives to use environmental technologies more effectively. Pollution monitoring systems have been established and system management has been improved over time. Furthermore, research and development (R&D) programs for pollution control have been implemented over the past two decades. The government has initiated a series of R&D programs involving studies analyzing atmospheric and water pollutants, solid waste, environmental planning, development of advanced technologies, and demonstration studies of pollution control. Also, many international organizations and foundations, such as the United Nations Development Programme (UNDP), the World Bank, Japan, the United States and others, have provided financial and technological support.

**History of Environmental Policy**

As the starting point of formal environmental management and administration, the government held the first National Congress of Environmental Protection in 1973. Pollution control during the 1970s, however, concerned only three forms of industrial waste – wastewater, waste gas and solid waste – and no effort was made towards pollution prevention and
abatement (Sinkule and Ortolano, 1995). At this stage, the actual authority of the local environmental agency was extremely limited. For example, industry bureaus and local factories resisted efforts by the local environmental agency to implement policy, by delaying or refusing to take action. Local government frequently intervened to help firms. Consequently, environmental protection laws were issued in 1979 and again in 1989.¹⁰

During 1982 and 1983, the most critical setbacks of these environmental agencies came with the structural reforms of the bureaucracy. As a practical result, the status of the environmental agencies decreased, and this weakened their managerial power. As a response to the damaged environment, changes in policy occurred in 1984, when the State Council established the National Committee for Environmental Protection, responsible for the coordination of environmental activities among the relevant ministries. Several changes in the policy occurred after 1984. For example, on September 15, 1987, the NPC approved the Law on Air Pollution Prevention and Control of the People’s Republic of China (LAPPC). According to the law, all plants that discharge pollutants into the air should comply with the rules for pollution control. Consequently, a series of policies and regulations was published by the government and a set of national standards related to air quality was established. In 1988, the status of the environmental agency was raised, and it took a more independent position from the other ministries.

But environmental protection has only really started to exert its full presence on the political agenda in China since the 1990s (Sinkule and Ortolano, 1995). Six environmental laws and regulations were revised and/or issued in the 1990s. One of the most significant changes in policy was the 1997 revision of the Panel Code of the People’s Republic of China, which added new articles on a charge of damage to protect natural resources and the environment, and a charge of misconduct in environmental management. In March 1998, the Ninth National People’s Congress swept in a radical reform of government administration. By 2001, 430 sets of environmental standards were in place at the central government level and 1,020 sets of laws, regulations, ordinances and rules at the local level.

A formal process for environmental impact assessment (EIA) has been used for more than 20 years. In October 2002, ‘The Law of the People’s Republic of China on Environmental Impact Assessment’, the new EIA law, was approved by the government and came into force on September 1, 2003. This allowed government agencies and other public and private sector bodies affected by the legislation time to prepare for the new requirements. Essentially, the new law superimposed a form of strategic environmental assessment for government plans and programs, but apparently not for policies, on the existing provisions for project-level EIA. In
general, the new law does not attempt to modify the existing EIA system in any radical way, suggesting that the government considers that current practices are satisfactory (Wang et al., 2003).

**Evaluation of Environmental Management**

Although the administrable status of environmental agencies has been enhanced, the actual implementation of environmental regulation has not improved dramatically. Insufficient authority and a lack of coordination between institutional actors appear to be the main reasons. In detail, these are: (i) the low environmental consciousness of managers; (ii) incomplete monitoring and compliance measures; (iii) environmental facilities being easily damaged by lowering maintenance costs; (iv) lack of environmental engineers leading to insufficient management; (v) insurance not supporting maintenance and control expenses; (vi) the low quality of the facilities (sometimes already broken when purchased); and (vii) the fact that it is often cheaper to pay charges than to pay pollution abatement costs (see, for example, Kai, 1996). As a result, environmental facilities often face difficulty in operation. Based on a report to the Fourth National Congress of Environmental Protection in 1996, for example, one-third of environmental facilities in large and medium-sized firms worked properly, another third did not work properly, and the remainder did not work at all. Ma and Ortolano (2000) also find evidence for problems in environmental protection management at the local level, where the administrative rank of the environmental protection bureaus is sometimes lower than that of the enterprises it is intended to oversee (ibid.; Economy, 2004).

Local government, instead of a higher-level environmental protection agency such as SEPA, provides the annual budget, approves institutional advancements in rank, determines changes in personnel, and allocates resources such as office buildings to the local environmental protection administrations such as the EPBs and EPOs. The local environmental protection administrations are then obliged to take local government into account when they regulate industries, since they depend, in part, on the local government.

There are considerable differences in size, funding, staffing and work methods between environmental protection agencies at the province level. Wealthier coastal provinces tend to be better funded, with more staff better technically trained than those in the poorer interior provinces. However, it is not necessarily the case that wealthier regions are more inclined to protect the environment. This is because individual commitment to environmental protection by local officials or leaders plays an important role in policy implementation.
The implementation of environmental policies is also sensitive to differences in economic development and environmental quality (Dasgupta et al., 1997; Wang and Wheeler, 2000). In addition, policy enforcement by local authorities diverges from the legal system established by the central government. In particular, the level of completeness in policy varies across polluting firms: some firms comply perfectly, while others do not (Wang and Wheeler, 1996). Chinese officials are often aware of the problem but have largely responded inadequately, with the demand for continuing economic growth superseding environmental considerations (Economy, 2004).

Wang et al. (2003), for example, concluded that the bargaining power of Chinese factories in enforcing pollutant discharge depended on the type of ownership, profitability and public pressure. Wang and Wheeler (2003) analyzed the determinants of differences in enforcement of the pollution levy system across urban areas. They found that effective levy rates are sensitive to regional ambient quality, local incidence of pollution-related complaints, factory profitability, ownership, production, sales and the sector. Evidence of administrative discretion can also be found in the studies by Wang et al. (2002). They measured townships’ environmental performance according to the number of township leaders’ visits/inspections, and whether townships provided environmental services. They found that environmental performance is dependent upon upper-level government environmental performance, GDP, the percentage of adult population employed in industries, worker wages, public pressure and environmental quality (Wang and Di, 2002; Wang and Jin, 2002).

For example, firms facing adverse financial conditions have more bargaining power and are more likely to pay lower pollution charges, that is, less enforcement (Wang et al., 2002). However, little is known about how environmental management changes over time.

NOTES

1. See Qian (1999) for an analysis of the institutional foundations of China’s market transition. There is a growing literature studying the transition of economies from socialist to market systems. One aspect of this literature examines why the Chinese experience differs from that in other transitional economies, including Russia, Vietnam and those in Eastern Europe. One major difference is that China’s economy is much larger and more diversified than most other transitional economies, with the exception of Russia. As a result, countries with a small and homogeneous economy can adjust their legal and financial systems much more easily than large countries (for example, Shleifer and Treisman, 2000). This is probably because it is easier for other countries to adopt drastic reform measures in the short run. China also differs because of the influence of Confucian philosophy. In this regard, people in China believe that fundamental changes in society should be gradual and only fully implemented after they are proved correct (Qian, 2003). This view, however, does not prevent regional experiments being conducted.
on a smaller scale. Accordingly, China adopted a gradual, ‘dual-track’ path in its economic reform, in that the continued enforcement of the existing planning system went alongside the fast-paced development of financial markets, as compared to the ‘big bang’ approach taken by some other countries (for example, Qian, 1999; Lau et al., 2000).

2. For more information, see World Bank (2001)
3. State-owned enterprise (SOE) reform by the government in this period increased enterprise autonomy and heightened profit incentives. Most economists agree that, despite the great effort in improving SOE performance, the most significant achievement was made by the fast entry and expansion of urban and rural nonstate enterprises. These firms were under tighter budget constraints and had better internal incentive structures. Indirectly, they also benefited from the various reforms aimed at the state sector, including fiscal decentralization, financial reform, the dual-price system and expanding SOE autonomy.

4. Central planning was usually aggregated, crude and not comprehensive, and plan fulfillment often was not a binding constraint. These features represented a significant departure from the textbook model of the Soviet system.

5. We take an example in the banking industry. Before the reform, there was only one bank, the People’s Bank of China (PBOC), which served as both the central bank and a commercial bank. In 1983, the State Council granted the PBOC the authority of a central bank and subsequently transferred commercial operations to four specialized banks. After 1984, local governments at provincial, municipal and county levels gained great influence over credit decisions through the regional branches of the central bank and state specialized banks.

6. A number of empirical studies have attempted to measure TFP growth for the Chinese state-owned sector. Although some find that economic reform made little or no contribution to TFP growth in the state sector, most find that such growth has improved since 1978. However, it still lags behind TFP growth in township and village enterprises (Jefferson et al., 1996). We also need to be cautious about the interpretation of SOE TFP because productivity is not necessarily a good indicator of enterprise performance in transition economies, given the nonprofit objectives of SOEs.

7. The National Environmental Protection Bureau, which was established in 1984, was then upgraded to the vice-ministry level as the National Environmental Protection Agency (NEPA). Finally, in 1998, NEPA was further upgraded to ministerial status and renamed SEPA.

8. Urban air pollution monitoring in China started as early as the mid-1970s. For example, more than 350 cities conduct routine urban air quality monitoring of the pollutants SO₂, TSP and NOₓ. In addition, Beijing, Shenyang, Shanghai, Guangzhou and Xian joined the Global Environmental Monitoring System.

9. These are provided to help improve the capacity of Chinese experts and researchers to solve pollution challenges for themselves. The investment in environmental infrastructure, including pollution control devices, cleaner production technology and natural gas pipelines, has also increased over time.

10. During this stage, a pollution charge or levy system was set up with Article 18 of the Environmental Protection Law of 1979 specifying that ‘in cases where the discharge of pollutants exceeds the limit set by the state, a compensation fee shall be charged according to the quantities and concentration of the pollutants released’. Effective levy rates are the levies actually collected per unit of above-standard wastewater discharge.

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