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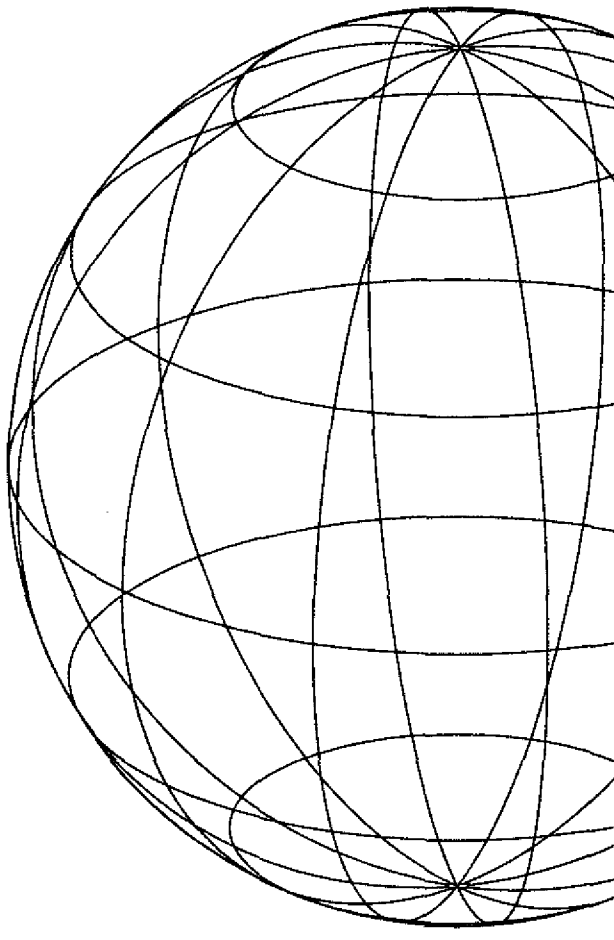
UNIDO RESEARCH PROGRAMME

Productivity Performance in Developing Countries

Country Case Studies

China



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UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
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Contents

List of tables

List of figures **Page**

List of boxes **Page**

Executive Summary

This case study of China is part of a broader research project for UNIDO known as *Productivity Performance in Developing Countries*. Based on data provided by UNIDO, this paper analyzes China's productivity over the last four decades. It provides an interpretation of productivity fluctuations in China, and examines the relationship among the different productivity trends and the overall economic growth performance of the country. The major determinants of productivity are identified, and within this context, the country's strengths and weaknesses, especially the latter, are assessed with regard to the factors related to productivity growth. The underlying goal of this paper is to provide a reference framework that will aid understanding of the impact of policy on productivity performance in China.

The paper consists of an introduction and three separate sections. The introduction includes a brief description of the background of the Chinese economy and of productivity research in China, along with the significance of this research. In Section I, the data on China's productivity over the last forty years are interpreted and analyzed. In Section II, the country's strengths and weaknesses in five groups of determinants of productivity are assessed. Finally, in Section III, several policy suggestions are discussed, based on the previous sections.

1. China's productivity changes based on UNIDO data: 1962-2000

The purpose of this section is to analyze and explain the changes in China's total factor productivity, technical efficiency and technical progress during the reporting period.

All data used for the analysis in this section are provided by UNIDO. According to UNIDO's research results from1962 to 2000, China's technological progress grew by only 1.7%, its technological efficiency by 18.3%, and TFP by 20.6%. The average change rate of TFP during the period from 1962 to 2000 was as little as 0.5% annually, and its rate of contribution to economic growth was only 7.9%. This is much less than in developed countries. This means that the source of economic growth in China comes mainly from the input of production factors, accounting for more than 90% of total growth.

However, if we study the period in stages, TFP's contribution to economic growth is seen to be much larger than when the period is investigated as a whole. In view of China's economic development and structural evolvement, we can analyze the results from UNIDO's productivity study in four chronological stages: the pre-Cultural Revolution period (1962-1966), the Cultural Revolution and adjustment period (1967-1978), the early stage of the reform period (1979-1992), and the deepening period of reforms (1993-2000). On the basis of these four stages, we have converted the annual rates of change calculated by UNIDO into period rates. In the four stages, the trend of TFP growth appears in two cycles: 6.3% in stage 1, -2.1% in stage 2, 1.5% in stage 3 and -0.8% in stage 4. When we divide the report period into two periods, before the reform and after the reform periods, we can see that there is a negative growth in TFP (-0.2%) before the reform period, and a positive growth in TFP (1%) after the reform periods. Obviously, reforms have been the key determinant of change in the trend of TFP growth before and after the reform period.

Compared with the USA, China's labor productivity increased from 3.92% of the USA's labor productivity level in 1961 to 9.57% in 2000, an obvious closing of the gap between the two countries.

There have been several studies of China's TFP in the last several years, all of which have used the single country model of China. However, because the UNIDO study includes a multi-national model and data calculated by the PPP index, UNIDO's results on productivity change have certain differences from these previous results. They show, mainly, that the change range was relatively small, but that the trends, especially the trends after the reformation period and China's opening-up, were similar, on the whole.

In this section, the basic reasons for the changes in total factor productivity, technical efficiency, and technical progress in China are analyzed. The analysis is carried out in three chronological stages: the pre-reform period, the early stage of reform and the deepening stage of reform. The growth rate change of TFP, from 1.5% in the early reform period (1979-1992) to -0.8% in the deepening period of reforms (1993-2000), is especially emphasized. By studying the trend of productivity change before and after China's reform, especially the downward trend of TFP after the initial post-reform, it is possible to understand the problems facing China's economy and find a solution to these problems.

A tentative analysis attributes roughly to the excessive deepening of capital and the excessive governmental intervention. Due to insufficient demand for consumption goods, China's economic growth has been driven by industrial investment. This is an immediate reason for high investment rates and excessive penetration. Economic growth propelled by years of investment is not sustainable without sufficient demand for consumption goods. In addition, excessive government intervention plays an important role in the excessive penetration of capital. Because of its incomplete market mechanism, China has had to rely on the government for the majority of important investment initiatives. However, the majority of government projects yield low economic returns.

2. China's productivity growth: Main sources and obstacles

This section assesses the determinants of productivity, analyzing them from five aspects: (i) institutional reform; (ii) technological progress; (iii) structure and factor allocation; (iv) social development; (v) restraints from resource endowment and environment. The major determinants of productivity performance in the last four decades are identified within these five components, and their influence on productivity is described.

Research shows that the main sources of growth for China's total factor productivity include both the productive potential created by institutional reforms, and the improvement in productive efficiency brought about by the import of technical and managerial know-how. To obtain sustainable TFP growth, China must make greater reform efforts to encourage domestic technological innovation, as well as to improve the quality of labor and modernize its economic structure.

In China, the factors that constrain productivity are constantly changing with economic development. Since the reformation period started, the economy has benefited from the "reform dividends" and the opportunities created by a series of measures. The rural reforms, the opening up of policy, the restructuring of production relationships, the property rights reforms centered on ownerships, the establishment of the socialist market economy, and the all-encompassing structural innovations have all been contributing factors.

China's immature market mechanism has the benefit of leaving room for institutional innovations to stimulate economic development. However, the stimulus will not be as strong as in the early stages of the reformation period. The key bottleneck for China's economic and productivity growth will shift in focus from the constraints posed by the basic economic system, to the challenges posed by specific policies aimed at such areas as "technological progress," "upgrading industrial structures," "further opening up of industry" and "further transformation of the dual economy system." In this new stage of reforms, China will also pay closer attention to the harmonious development of the economy, society, and the environment.

For over 20 years, China's institutional reforms have had enormous success in raising the country's productivity. Without any available model to follow, China has taken progressive steps to change its economic system from top to bottom, first taking simple steps, which were then followed by more difficult reforms. The first reform went through the process of revitalizing the old economy and opening China up to the outside world in the 1980s, followed by a further opening up and the development of a more formally established socialist market economic system in the 1990s. China has changed from a planned economic system, characterized by high unification and central control, into a market economic system where resource allocation is decided by market mechanisms. Through this process it became evident, as reform brought about rapid economic growth and improved TFP, that the planned economy was the institutional cause of low total factor productivity.

It is important to remember, however, that China's economic system is still far from perfect, and that productivity development faces a great deal of systemic obstacles. The restrictions on factor allocation and on the formation of effective incentive and restraint mechanisms are discussed in this section. China's market economy currently has major defects in factor allocation. Generally speaking, the commodity markets are relatively well developed, but the factor market has, as yet, lagged behind. The capital and labor markets are also facing formidable institutional obstacles. The perfection of these markets requires the transition of the government's function, the further reform of the financial system, state-owned enterprises (SOEs), and the household registry system.

Unconstrained drives for profit are the main culprits for the disorder from which China has suffered in its transition period. Deepening the reform is the only solution. Both the government and the legislature have designed many favorable policies to facilitate fair competition and regulate economic order. The implementation of these policies, however, will be a time-consuming process. China is a country with thousands of years of experience of being ruled by individual will rather than by laws. It is also the world's largest developing country with a per capita GDP of only $1,000. One can only speculate about how difficult it will be for such a country to complete the revolutionary transition to an economic system founded on law and credit.

Since the reform, technical progress has helped China make remarkable achievements in its industrialization processes. As a developing country, China's technical progress relies to a great extent on imitating and importing from developed countries. The imported technologies are then transformed, digested and absorbed to fit the country's economic conditions. Although China still lags a considerable distance behind developed countries in advanced technologies, gaps in other areas, especially comprehensive production technologies, are constantly shrinking. Nevertheless, the room for further importation of technologies is getting smaller. Independent innovations will play an increasingly important role in the country's

future development. How to strengthen China's capacity for independent innovation therefore becomes a critical issue.

Chinese enterprises have little capacity for independent technological innovation. They own few intellectual property rights and rely on foreign countries for important or large equipment. The key technologies used in industries with huge production capacities, such as IT and telecommunications, are all owned by foreign enterprises. The technological gap between China and developed countries will, therefore, continue to widen unless Chinese firms are able to increase their core competitiveness through independent innovation.

This section analyses the reasons for insufficient technological innovation in China, for example, the low level of economic development, institutional and systemic obstacles and its restrictions, and the small proportion of expenditure on digesting, absorbing, and transforming imported facilities compared with the total spending on technological importation. It also discusses the large number of small-sized firms, the inadequate protection of intellectual properties, and the strategy of "exchanging markets for technologies".

China's strategy of "exchanging markets for technologies" has proven to be only a modest success. The strategy has failed to realize all its expectations. In the past decade of implementation, it has played a positive role in obtaining low-end technological products and advancing China's technological and production levels at least in the short run. However, in return, foreign-invested firms have gained an enormous market share and control the majority of key technologies, brands, and sale channels. They also enjoy a monopolizing position in certain industries and manufacturing bases transferred to China. Chinese enterprises, on the other hand, have difficulty cultivating brands and are unable to gain key and advanced technologies. At the same time, their capacity for independent innovation has made little progress, and they are reduced to scrambling for meager profits at the lower end of the global production chain.

Technological progress and transition from a planned economy to a market economy have, inevitably, created great structural changes in China. In the transitional period, institutional changes provided a strong impetus for change in the industrial structure. This section analyzes how this directly effects the transformation of the industrial structure, including structural changes across the industries, the structural upgrading of the industrial sector, increases in non-agricultural employment, urbanization, economic growth pattern, high investment rate and economic fluctuations on productivity growth.

China's experience of economic development has demonstrated the strength and efficiency of the market. However, it is now an acute problem in China that social development lags behind economic growth. A potential source of social instability, this imbalance has adversely affected economic growth and the improvement of productivity. This section analyzes the negative impact of the widening income gap, and the sluggish development of the public sector, social security, public health, education, and economic growth.

Because the factor of ecological and environmental resources is not included in the accounting system, the GDP output and input of factors involved in the calculation of total factor productivity does not make allowance for the adverse impact of environmental damage on the economy. China's rapid economic growth and increase in total factor productivity have, to a great extent, been obtained through over-exploitation of ecological and environmental resources. However, these growths are virtually unsustainable. In discussions

of increasing total factor productivity, one should be careful that one does not tend solely to the pursuit of economic and productivity growth.

3. Policy suggestions

The analyses in the previous sections focus on nearly all aspects of the economic system. This indicates that efforts for the improvement of total factor productivity should be systematic, and the countermeasure adopted should be comprehensive. This section analyzes the two most important aspects of improving China's productivity: strengthening the innovative ability of enterprises and developing the educational system.

On strengthening the independent innovative ability of Chinese enterprises, the author presents the following three suggestions: (i) adjust the development strategy of depending unduly on foreign capital, and follow the principles of promoting technological progress and sustainable development; (ii) cultivate an independent technological development ability and brand marketing ability on the basis of self-owned capital; (iii) deepen reform to create favorable external conditions and incentive mechanisms for technological innovation, including deepening the state-owned enterprise reforms further, accelerating the transition of the government's function, and perfecting the mechanism of venture investment and financing.

The positive role of the rapid development of China's educational system in raising the country's productivity, and the main challenges to this development are analyzed in this section. Emphasis is also given to energetically developing education, and accelerating the development of manpower resources. The author thinks that certain policy adjustments must be carried out. These include: (i) solve the problem of insufficient input for education which has existed for a long time; (ii) the government should put efforts into solving the serious inequality problems in Chinese education and implement a rational allocation of educational resources; (iii) strengthen professional education and perfect the human resources market to meet the needs of a socialist market economy; (iv) upgrade the approach taken to education, deepen educational reform, and change exam-oriented education into quality-oriented education.

I. Introduction

Since the establishment of the People's Republic of China in 1949, China has changed enormously. It has transformed itself from a poor, backward, semi-feudal, semi-colonial country into a vigorous socialist country in which people's living standards have risen and the national economy has achieved the first stages of prosperity.

China's road to economic development in the past 55 years has not been smooth. Before implementing reforms and opening-up its doors, begun in1979, the country's economic development was mostly carried on under a planned economic system. From 1949 to 1978, China set up a more complete industrial system and a national economic system, and achieved a high economic growth rate. In the 30 years before reformation (1949-1979), China's gross domestic product (GDP) increased by 6.7 times, or at an average annual rate of 7.3%. Compared with other countries in the world, this growth has been particularly fast. However, this faster growth has been inefficient, being based on high input, and people's living standards have not achieved a corresponding improvement. Growth has, therefore, not been sustainable. A large amount of research, including the current UNIDO study of 15 countries' productivity, shows that, before the reformation and opening-up, China's total factor productivity (TFP) did not improve, and may even have declined[1].

Since the reformation and opening-up, China has entered the industrialization stage, taking the meeting of market demand as its direction. Thus, the speed of economic growth has obviously increased. In the 25 years from 1978 to 2003, its gross domestic product (GDP) increased by 8.4 times, an average of 8.9% per year. It is notable that, following the implementation of the policies of reform and opening to the outside world, great change has taken place in China's growth. Through the reform of the last 20 years, China has already set up a tentative socialist market economy system. The market mechanism plays a larger role in resource allocation, economic connections with the worldwide economy are becoming increasingly closer, and economic efficiency is increasing. Economic growth now depends increasingly on the improvement of technical progress and on growth in the quality of labor. Most research indicates that, since the reformation and opening-up, there has been a notable improvement in China's total factor productivity or TFP's rate of contribution to economic growth was more than 30% in the 1980s and the early 1990s. Research by the World Bank (1997) shows that, from 1978 to 1995, TFP growth contributed to GDP growth by up to 43% at the annual average[2], and the estimated results from the Chinese Academy of Social Sciences is 36.2% for the same period. The improvement of TFP is the main source of China's economic growth during this period.

However, recent research indicates that productivity showed a downward trend in the late 1990s. Gary Jefferson et al have examined the tendency of the industrial productivity of state-owned and collective-owned enterprises for 1980-1996, and that of five kinds of enterprises, such as foreign-investment enterprise, share-issuing enterprise, and other domestic enterprises, for 1988-1996. The results indicate that there is a long-term growth of total factor productivity (increasing by 2.62% every year from 1980 to1996), but that the rate of growth

[1] The result should not been accepted simply. Further analysis is needed (see Column 1: To understand the economic background of measuring China's TFP).

[2] World Bank (1997), "China 2020: Development Challenges in the New Century", in which resources of China's economic growth are divided into 4 parts: capital accumulation, employment increase, growth of human capital and TFP.

has presented a downward trend since the 1990s (dropping by 2.25% every year from 1993 to 1996). The firms classified as "other ownership industry" (excluding state-owned and collective industry) are not as vigorous as expected. After excluding the productivity change which is influenced by fluctuation in the economic cycle, the downward trend of industrial productivity remains obvious in the 1990s. But before 1990, no lasting downward trend of productivity ever appeared for any kind of ownership. Since 1990, we have found various downward trends of industrial productivity despite a high growth rate. In 1994 and 1995, the annual actual growth rate of the industrial output of each ownership type was more than 20%, but the decline of productivity still followed.

Professors ZHENG Jinghai and HU Angang (2004) have estimated China's total factor productivity (TFP). Using provincial data, they investigated the nature and tendency of TFP growth in recent years with respect to technical efficiency and technical progress. The results show that China's economic growth went through a period with a high rising TFP (at an annual average of 4. 6%) from 1978 to 1995, and a period with low TFP growth (at an annual average 0. 6%) from 1996 to 2001.

They point out that adopting Solow's growth accounting formula with the growth rate of GDP, capital stock, and employment by setting capital weight as 0.6 and employment weight as 0.4 to estimate the growth of productivity, the annual average growth rate of total factor productivity from 1995 to 2001 was still only 0.64%, and only accounts for 7.8% of the GDP average annual growth rate. The average annual growth rate of TFP was 3.16% during 1978-1995, accounting for 33.6% of GDP growth. This demonstrates the enormous difference in productivity growth between these two periods.

UNIDO's comparative study of the productivity of 15 countries investigates the change in China's TFP in 1962-2000. Because this study employs a multinational model and data calculated by a PPP index, UNIDO's results on productivity change have certain differences from the above-mentioned results by the single country model of China. They show mainly that the change range is relatively small, but, on the whole, the trends are similar, especially the trend since the reform and opening-up. The results indicate that before the reform and opening-up, the growth of TFP was basically negative (see Appendix Table 1). However, since the reform and opening-up (1979 to 1994), the growth of TFP has been positive except for specific years (average annual 1.5%). There was a continuous negative TFP growth from1995 until 2000 (average annual -0.8%).

It is important to study the trend of productivity change before and after China's reform. Analyzing the downward trend after the initial post-reform TFP increase, in particular in order to clarify the reason for the TFP growth downturn, is very significant for understanding the problems of China's economy. In addition, it is important in solving China's economic problems, in improving the quality of China's economic growth, and in ensuring that China's economy develops in a sustained and healthy manner.

Box 1 To understand the economic background of measuring China's TFP

Since Solow put forward the famous growth accounting model, TFP has become a broadly used indicator for evaluating the quality of economic growth. Professor Krugman questioned the miracle of East Asia using the research results of Lawrence Lau al et as evidence to show the low contribution of TFP improvement to economic growth in East Asian economies.

However, TFP is a measure of economic performance; its usage is conditioned and has a certain scope. The results of TFP should be analyzed specifically. When we make use of the change of TFP to evaluate the quality of China's economic performance, we need to study the special background of the Chinese economy.

For example, before reform, China implemented a system of planned economy. Almost all prices were established by the government, not by the market, resulting in serious price distortions. At that time the state carried out the strategy of developing heavy industry as its top priority, with agriculture in the role of supporting industry. In order to carry out this strategy, the prices of raw materials and agricultural products were all set at low levels. (This also explains why the prices of raw materials and agricultural products all rose significantly after the introduction of market mechanisms.) The higher relative price of capital goods caused by this policy leads to the possibility of understated TFP growth.

In addition, the phenomenon of shortage was a major feature of China's economy at that time. Obviously, the Chinese economy deviated widely from the state of general equilibrium before reform. The relationship of input to output calculated according to the plan price is also obviously different from that calculated according to the market price. As a result, the TFP before reform and the TFP after reform are, to a certain extent, incomparable.

Even after reform, the Chinese economy is still in the transitional period from a planned economy to a market economy. During this period, many prices of products, services and production factors are not decided by the market. For example, under the double track price system once practiced for a period of time in the Chinese economy, the same kind of production material could have two prices at the same time - one under the plan, another outside the plan.

Moreover, at the early stage of reform, quite a lot of product, service and production factors (such as land) had no market value, because they were not yet recognized as commodities. Later, they experienced a process of gradual commercialization. These changes have an impact on the consistency of the input and output data used in TFP calculation.

It is notable that when the data on capital input for the use of TFP calculation are produced by the perpetual inventory method based on investment data, there will be a time difference between input and output. If the amount and structure of investment fluctuate greatly, the investment of the current year will obviously be inconsistent with the output of the current year, which might impact the TFP results. China fits this case exactly.

Change in TFP can only be estimated by calculation of the growth residual, which includes the growth caused by factors that cannot be observed directly. The factors influencing "the residual" are very complicated. Besides output, the "residual value" will also be affected by factor inputs and technical progress, institutional change, macroeconomic policy, and the division of report period, etc., will also affect "the residual value". The effect of institutional factors on "the residual" can be neglected in those countries with stable economic systems, but in China in transition institutional factors will have a great effect on "the residual".

Finally, we would like to point out that China is a nation with the significant characteristic of having a dual economy. Its territory is big, with correspondingly large gaps between cities and country, so that regional differences and income gaps are also large. This means that we cannot offer a simple description of the performance of China's economy, nor can we get an overall picture of it simply by looking at an average index of TFP. As a result, the importance of the index of TFP should not be exaggerated.

In short, the measurement of TFP not only includes the growth caused by all the unidentified factors, but also includes all errors of concept and measurement. We should remember that TFP, as a concept or index with ambiguous content, has obvious limitations in studies of economic theories and policies.

II. Accounting China's Productivity Changes Based on UNIDO Data: 1962-2000

Given China's economic development and structural evolvement, we will analyze the results from UNIDO's productivity study in four chronological stages: the pre-Cultural Revolution period (1962-1966), the Cultural Revolution and adjustment period (1967-1978), the early reform period (1979-1992), and the deepening period of reforms (1993-2000).

These four stages are the basis of our conversion of the annual rates of change calculated by UNIDO (see Table 1 in the Appendix) into period rates (Table 1).

Table 1 Average annual change rates of total factor productivity, technological progress, and technological efficiency (%): 1962-2000

Period	DGDP	DTFP	DTP	DTE	DKL	DLP	DTFP/DGDP
Pre-reform: 1962-1978	4.4	-0.2	-3.6	3.5	2.8	2.0	-4.5
Stage 1: 1962-1966	7.5	6.3	-3.6	10.2	-2.4	5.6	84.0
Stage 2: 1967-1978	3.7	-2.1	-3.8	1.8	4.7	1.1	-56.8
Post-reform: 1979-2000	7.5	1.0	3.1	-2.1	7.2	6.0	12.7
Stage 3: 1979-1992	7.6	1.5	0.2	1.4	6.0	5.2	20.2
Stage 4: 1993- 2000	7.2	-0.8	8.8	-8.8	8.5	6.2	-10.8
Report period: 1962- 2000	6.3	0.5	0.0	0.4	5.2	4.2	7.9

Note: GDP and capital inputs are calculated using PPP indices.
DGDP: annual change rate of GDP; DTFP: annual change rate of total factor productivity;
DTP: annual change rate of technological progress; DTE: annual change rate of technological efficiency;
DKL: annual change rate of capital deepening (K/L); DLP: annual change rate of labor productivity (GDP/L)

1. Trend analysis of China's total factor productivity

1.1 Brief review of China's economy and accounting practices for productivity

1.1.1 Review of economic growth

The People's Republic of China spent the first three years after its birth in 1949 recovering its economy from the debris of war. With the help of the former Soviet Union and other socialist countries, China begun the implementation of the first Five-Year Plan in 1953. By the year 2000, it had completed nine five-year-plans, with an adjustment period of 3 years between 1963 and 1965. The UNIDO productivity study of 15 countries covers the period between 1962 and 2000. All data used for the analysis in this section are borrowed from UNIDO's data on GDP and capital stock calculated with purchasing power parity indices.

China's GDP has kept expanding for almost the entire report period, except in 1968 and 1989 (see Table 1 in the Appendix). From 1962 to 2000, GDP increased accumulatively by 10.47 times (see Table 2 in the Appendix), or at an average annual rate of 6.3% (see Table 1). As Fig.1 shows, China's economy grew at a mild rate of 4.4% per year from 1962 to 1978.

This period followed closely on the so-called "three difficult years"[3] (1959-1961) in Chinese history. Affected by the "three difficult years", the economy grew at low rates in 1962 and 1963, before recovering to over 10% growth in 1964 and 1965. This contributed to a relatively high average rate of growth of 7.5% between 1962 and 1965. The trend of growth was reversed, however, as the Cultural Revolution, beginning in 1966, brought political instability and consequently economic disorder. In particular, the year 1968 saw China's growth rate sink to a negative 3.19%. Technological progress, capital deepening and labor productivity all experienced large negative growths. In 1969 the nation's economic order began the process of restoration. China's economy grew by over 10% in that year, from a low basis, and fluctuated gently afterwards until the end of the Cultural Revolution in 1976. By 1978, China had returned to a normal economic order. Its economic growth averaged 3.7% during and immediately after the Cultural Revolution (1966-1978). Thus the average growth rate of the entire pre-reform, pre-opening-up period was 4.4% per year.

Since the beginning of market-oriented reforms at the end of 1978, institutional innovations[4] have propelled economic growth. From 1979 to 2000, the average annual growth rate (PPP) was 7.9%, much higher than the pre-reform rate of 4.4%. In the early stage (1979-1992), the so-called "reform dividends" helped release China's economic potential, and its economy grew at an average annual rate of 8.3%. The only exception was the year 1989 when political turmoil lowered the growth rate to 3.24%. Apart from growth rates, other aspects of the economy, such as technological progress, technological efficiency, and labor productivity, were also significantly affected. In 1992 China confirmed its goal as that of establishing a socialist market economy. The quickening pace of reform, however, led to the overheating of the economy in 1992 and 1993. Between 1993 and 2000, contractive policies aimed at achieving an economic soft-landing, combined with the Asian financial crisis in 1997, reduced China's economic growth to a level similar to the early stage of the reform, at an average annual rate of 7.2%. Nevertheless, fundamental progress was made in the reform process. Market mechanisms began to play a leading role in resource allocation, and economic opening reached a higher level, with increasing numbers of large multinational corporations entering China. As shown in Table 1, this period witnessed remarkable increases in the nation's technological progress, capital deepening and labor productivity. However, technological efficiency experienced large negative growths, which indicated that the allocation of resources was still suboptimal and that there was a large amount of production capacity not being utilized. The problem now troubling China's economy has changed from one of overheating in 1992 to that of insufficient domestic demand, especially after the Asian financial crisis in 1997. In an effort to stimulate domestic demand, the government has adopted an expansive financial policy of issuing government bonds, hoping to steady economic growth at a high level through large investments.

[3] The "three difficult years", or "three years of natural disasters" refers to the period between 1959 and 1961, during which the national economy of China was besieged by a series of catastrophes: steep drops in industrial production, severe shortages of food and daily necessities, overall market contraction and wild inflation. The outbreak of catastrophes could be attributed externally to the rare natural disasters that afflicted China for three consecutive years from 1959 to 1961, and the end of Soviet aid to China. Internally, the nationwide pursuit and zest for economic miracles which flared up during movements of "Great Leap Forward" and people's commune, severely strained China's economic resources, with damaging consequences for the national economy.

[4] For details, see Section I. 2.2, "The Early Days of the Reform", part of Section II.1, "Structural Reform", and Column 2, "How was Market Competition Introduced in China?"

1.1.2 Accounting for total factor productivity (TFP)

Our research focuses on the dynamics of China's TFP and its contribution to economic growth. Research by UNIDO shows that the calculated growth rates of TFP differ according to the method of periodization used. For example, the average change rate of TFP during the entire reporting period from 1962 to 2000 was as small as 0.5% annually, and its rate of contribution to economic growth was 7.9%. However, if we study the period in stages, TFP's contribution to economic growth, positively or negatively, was shown to be much larger than when the period was investigated as a whole (see Table 3 in the Appendix).

Between 1962 and 1965, TFP's contribution to economic growth reached an historical high of 84.0% per year, as did the average annual rate of TFP growth of 6.3% during the same period. Apparently, this could be attributed to the economic recovery China experienced after the "three years of natural disasters."

The contribution of TFP to economic growth took a drastic turn between 1966 and 1978, reaching an historical low of -56.8% per year. During this period, TFP's annual change rate remained negative, except in 1969 and 1977. In other words, China's total factor productivity kept decreasing, which manifested the destructive effects of the Cultural Revolution on productivity. When the above two stages (1962–1965 and 1966–1978) are taken together, China's pre-reform, pre-opening total factor productivity declined slowly at an annual rate of 0.2%, with an average contribution rate of -4.6%.

After China started its reform and opening-up policy (1979-2000), its TFP increased overall at an average annual rate of 1%, slightly higher than the rate of decrease during the pre-reform period. The trend of change was, however, not consistent. In the early stage of the reform (1979-1992), TFP increased for most of the time at an annual rate of 1.5%, with brief decreases only in 1985, 1988 and 1989 (see Table 1 in the Appendix). Starting from 1993, however, the growth of TFP slowed down and declined for five consecutive years, before improving again in 2000. Between 1993 and 2000, when China's economic reform was carried to a more profound level, the average growth rate of TFP was -0.9% per year. Moreover, the contribution to post-reform economic growth of TFP was 12.7% for the duration of the report period. In particular, the contribution rate reached 20.2% in the early stage of the reform before declining dramatically to -10.8% in the mid and late 1990s.

Breaking down the changes of TFP into variations in technological progress and technological efficiency reveals the following. Before the reform, China's technological progress was in a sluggish state, changing at the rate of -3.6% every year, with modest advances only in 1962, 1973, 1974 and 1977. Meanwhile, the change rate of technological efficiency averaged 3.5% annually, slightly lower than the average decline rate of the technological level. As a result, China's total factor productivity decreased smoothly during this period. Further examination shows that China enjoyed rapid increases, averaging 10.2% per year, in technological efficiency between 1962 and 1965, thanks to its economic recovery after the "three years of natural disasters" and before the Cultural Revolution. Its TFP, therefore, grew at an annual rate of 6.3%, despite the decrease in its technological level. However, of the 13 years between 1966 and 1978, six were characterized by declining technological efficiency, which indicated that China's production capabilities were not put to efficient use.

During the 21 years after the reform started, China's general technological level grew significantly by 3.1% per year, entering the realm of positive technological progress. Compared with the pre-reform period, however, the country's technological efficiency performed poorly, declining by an annual rate of -2.1%. Examining these two indices by sub-periods, we see from Table 1 in the Appendix that the change rate of technological progress was 0.2% and that of technological efficiency was 1.4% between 1979 and 1992. The data show that the technological level experienced small advances in the early stage of the reform. Moreover, structural innovations released part of the nation's potential technological efficiency, thereby improving total factor productivity.

After 1992, the influx of foreign capital helped fuel rapid increases in China's technological level (See Table 1). The years between 1993 and 2000 witnessed remarkable technological progress, at a rate of 8.8% per year. However, declines in technological efficiency were equally significant, with decreases also of 8.8% per year. As a result, TFP dropped slightly, at an annual rate of -0.8%. This shows that China's technological potential was not yet fully realized.

According to UNIDO's results, for the entire report period between 1962 and 2000, China's technological progress grew by only 1.7%, its technological efficiency by 18.3%, and TFP by 20.6%. One possible explanation is that, under pressure from its fast expanding labor forces, China emphasized the development of labor-intensive industry at the expense of capital- or technology-intensive industries.

Nonetheless, as prices in the planned economy were not determined by the market, calculations using pre- and post-reform price data are completely comparable. Comparative analyses *within* each period may yield more meaningful results.

1.2 Comparison with other developing countries

Fig. 2 shows the trend of changes in TFP for China, India, Indonesia, South Korea, four Latin America countries and nine African countries. Of these countries and regions, China ranks among the lower middle in the rate of TFP increase. Its TFP rose at a faster pace than that of India between 1961 and 1974, before falling behind from 1975 to 2000. However, it grew at a consistently higher rate than those of both South Korea and Indonesia.

From 1962 to 1971, China's TFP grew faster than the average level of the four Latin American countries, but lagged behind after 1972; and faster than the average level of the nine African countries, between 1962 and 1971, but fell behind them from 1972 to 1982, rising again between 1983 and 1986, only to have lagged behind ever since.

By 2000, the growth rate of total factor productivity relative to 1961 was 1.206 in China, 1.255 in India, 0.512 in Indonesia, 1.118 in South Korea, 1.317 on average in the four Latin American countries, and 1.407 on average in the nine African countries. From 1962 to the closing days of the Cultural Revolution, China's TFP level was ahead of those of other developing countries. Since the reform started, however, its development of TFP has fallen behind. Breaking down the changes of TFP into variations in technological progress and technological efficiency reveals the predominant cause.

China's technological progress remained sluggish between 1961 and 2000, keeping abreast of that of Indonesia (see Fig. 3). However, it was ahead in technological efficiency (see Fig. 4), thanks to which its TFP growth enjoyed a modest advantage over other developing countries before the reform, despite the backward state of its technological progress. In the post-reform years, especially after 1992, growth in China's technological efficiency embarked on a downward trend, while that of other developing countries started to increase, catching up with China's level. This change in the relative efficiency levels, strengthened by the advantage in technological progress these countries already enjoyed over China, helped their TFP levels overtake that of China.

Comparing China and other developing countries on the trend of changes in their total factor productivity therefore shows that, in order to improve productivity, China must make more efforts to prevent its level of technological efficiency from further declines, while speeding up technological progress.

Compared with the USA, China's labor productivity increased from 3.92% of the USA level in 1961 to 9.57% in 2000, which shows a gradual closing of the productivity gap.

2A Brief Analysis of the Changes in China's TFP, TE and TP during the Report Period

This section will study the fundamental causes of the changes in China's total factor productivity, technological efficiency, technological progress and economic growth briefly described above. The analysis will be carried out in three chronological stages.

2.1 The pre-reform, pre-opening-up period

Upon its birth in 1949, the People's Republic of China had scarce means of production and an almost non-existent manufacturing industry. It produced less than a million tons of steel every year. Against the backdrop of the economic embargo imposed by western countries, China developed a planned economy that played a critical role in the centralized allocation of limited resources for the nation's economic resurrection. Because the scarcity of resources constrained economic growth, China lived with shortages for a long time before the reform. In the initial stage of industrialization, centralized allocation guaranteed the financing of a number of key industrial projects. There was, therefore, significant improvement in China's technological efficiency level from 1962 to 1970.

From the 1970s, however, with the expansion of China's economic scale, the planned economic system began to show its weaknesses, the most striking of which were the lack of incentives and information to guide the government's economic plans. The planned economy was slow to adjust to the rapid economic development that had tremendously increased the level of sophistication of economic planning. Moreover, the damage to the economic structure wrought by the Cultural Revolution placed China's technological efficiency level on a continuous downward trend. The brief increases in technological efficiency in the closing years of the Cultural Revolution (1975 and 1976) were short-lived by-products of the renormalization of the economic order. The downward trend resumed soon afterwards.

From the viewpoint of technological progress, enterprises in a "shortage economy" lacked the incentive to introduce advanced technologies, improve quality, or increase factor productivity. For a long time after 1949, China's economic growth was propelled by political zest.

Statistical growth rates were frantically pursued at the expense of economic returns, and investment pursued at the expense of technological progress. This coincided with explosive increases in the size of the population and the labor force. To give a job to every worker, China was forced to lay a strong emphasis on labor-intensive industries. The centralized, egalitarian labor and distribution systems, however, were poor stimulants of worker incentives. Moreover, the economic embargo and the difficulty of introducing advanced technologies also had adverse effects on China's technological progress.

Thus, despite fast economic growth, China's economy in the pre-reform period suffered from a hostile international community, weaknesses of the planned economic system, and a series of failures in economic planning. All these factors hindered the country's technological progress, and pushed it in the direction of exogenous economic growth, manifested in low or even negative growths in total factor productivity.

2.2 The early stage of the reform

Lessons from the Cultural Revolution brought Chinese policy-makers to the full realization of the political and economic errors committed in the past. They turned to concentrate on the central task of economic development by initiating reforms of the economic system and opening up the economy to the outside world. It is generally acknowledged that China's reform started with the Third Plenary Session of the Eleventh Central Committee of the Chinese Communist Party at the end of 1978. The early stage lasted from 1978 to 1992, while the reform deepened between 1993 and 2000.

Economic reform began in the rural areas with the implementation of the family responsibility system, while in the urban areas a series of initiatives were put in place to reinvigorate large and medium-sized state-owned enterprises. These initiatives aimed to alter the role of government as well as the management mechanisms of enterprises. By strengthening and developing the public sector of the economy, the reform also encouraged the growth of other types of ownership, such as individually owned businesses, private firms, foreign capital, etc. This institutional innovation stimulated the productivity of farmers and industrial workers, thus improving the nation's technological efficiency and resource allocation. As is shown in Fig.1 and Fig. 4, China's technological efficiency level during this period increased with small fluctuations.

We learn from Fig.1 and Fig. 3 that little or no technological progress was realized during the early stage of the reform. In this period, China, with its poor investment environment, was not able to attract large sums of foreign capital or technology of an advanced level. Foreign investors came mainly from Hong Kong and Taiwan, and brought with them manufacturing capacities embodied in complete sets of equipment and instruments. Advanced technologies occasionally introduced from developed countries could not be fully absorbed. As a result, China's technological level progressed slowly, making few advances on its technological frontier.

As is shown in Fig.1 and Fig. 2, total factor productivity was on an upward trend in the initial stage of the reform, thanks, apparently, to increases in its level of technological efficiency. Improvements in TFP could, therefore, be attributed to the potential for technological efficiency released by the structural innovations that took place during the transition from the planned to the market economy.

2.3 The deepening stage of the reform

After China confirmed, in 1992, its goal of developing a socialist market economy, the reform entered a stage of deepening. However, the growth of total factor productivity appeared to slow down, and a downward trend continued from 1993. At the same time, technological progress improved remarkably from its negative growth, but technological efficiency appeared to do the opposite, and continued on a downward trend for seven years.

It is easy to understand the remarkable technological progress China experienced. From 1993, transnational corporations increased their investments in the country, drawing in large amounts of foreign capital and advanced technology. At the same time, a series of important market-oriented measures were implemented.

The downward trend of TFP was caused by a similar downward trend of technological efficiency. Many factors contributed to the quite significant declines in technological efficiency, such as problems in investment structure and changes in economic environment, both at the domestic and international levels. This is a topic that calls for further investigation. A tentative analysis attributes it roughly to two factors: excessive deepening of capital and structural defects.

2.3.1 Excessive deepening of capital and the decline of TFP

China's economic development has always been characterized by large amounts of investment, which was manifested in the country's economic growth from 1993 to 2000. The flood of real estate investments in 1992 and 1993 gave rise to economic overheating, with the inflation rate (CPI) reaching 24% in 1994. In the wake of runaway inflation, the central authorities applied a re-adjustment policy to the economy. As a result, the growth rate, as well as the inflation rate, declined for consecutive years (see Appendix, Table 4). The Asian Financial Crisis in 1997 had a further cooling effect on the economy. The economy also began to suffer from an insufficient domestic demand that was attributable to the adverse influences of China's various deep-rooted socio-economic problems as well as to its domestic industrial structure and to a weak world economy. In an effort to spur domestic demand, the government changed its fiscal policy, from 1998, from contraction to expansion. Between 1997 and 2000, it issued 1.3496 trillion *yuan* worth of government bonds, used for the construction of public infrastructure. The expansive fiscal policy was effective in temporarily relieving the pressure of insufficient investment demand, but it could do little to create enough demand for consumption goods. Large government investment was also augmented by high domestic savings, the influx of foreign capital, and the massive mobilization of capital in the development project for the vast western inner lands of China. The investment rate remained at a high level after 1993 (see Appendix, Table 5), increasing consistently for years until it reached 51% in 2004. In the meantime, with the intensification of reform efforts

after 1993, large numbers of workers were laid off from state-owned enterprises and, in their place, capital began to play a larger role in the economy. Capital-intensive technologies replaced labor-intensive ones. China had evolved into a dual economy.

Table 1 shows a correlation between the fast growth of investment and changes in the capital-labor ratio (K/L). As a result of the acceleration of capital penetration, the growth rate of the K/L ratio in 1993-2000 was 2.5 percentage points higher than in 1978-1992. However, the productivity of labor (GDP/L) increased by only 1% (see Table 1), a manifestation of diminishing marginal returns to capital.

Statistics indicate that the amount of capital owned by state-owned enterprises increased dramatically after 1993. The capital rate rose to 7.9%, 1 percentage point higher than in the initial period of the reform, and was maintained at this level during the "deepening" stage. Excessive capital penetration, much of which was invested in infrastructures, could, however, not yield high returns in the short run. The resultant diminishing marginal returns of capital were the reason for decreases in technological efficiency and total factor productivity.

From the 1990s, China has had to tackle the problem of insufficient demand for consumption goods. This is also an important factor behind the excessive capital penetration. This was a problem beyond the capacity of macro-economic policies. The causes of this weakness in demand were two-fold: deceleration of the growth of per capita income and declines in the marginal propensity to consume.

Since the 1980s, the income of the Chinese grew more slowly than GDP for most years, especially after the seventh Five Year Plan (1986-1990) (see Appendix, Table 7). As a result, the share of personal income in GDP fell.

The slow growth of income could be attributed to structural changes and industrial restructuring in the Chinese economy. Intensified competition reduced the profit margin of the manufacturing sector (see Appendix, Table 6). The reform also decreased the number of jobs. The number of unemployed increased, without the protection of a well-established social security system. As a result, the growth of personal income slowed down.

Most of the slow growth of income took place in the agricultural sector, the result of a stagnant urbanization process (see the section on flaws in the labor market). The sluggish growth in income for farmers caused, in turn, a downward pressure on the price of labor in urban areas. In summary, slackening income growth in rural areas and the widening gap in income between the rural and the urban regions were the major causes of China's insufficient demand for consumption goods.

The weakening of the propensity to consume was associated with a high savings rate, which has been maintained at about 40% since the 1990s (see Appendix, Table 9). The rate is significantly higher than that of other nations with high savings rates. From 1978 to 1999, for example, the national savings rate of Hong Kong was 32.8%, 31.3% in Japan, 32.5% in Korea, and 30.6% in Taiwan. The factors that contributed to China's high savings are the following:

(i) Lack of alternative investment tools. China's poorly developed capital market could offer few low-risk investment opportunities other than savings (see the section "Restriction from Flaws in the Capital Market").

(ii) Uncertainty about the future induces the Chinese to save. The Chinese economy was in a structural transition. Instead of pursuing a clear and definitive goal, its reform followed the strategy of learning by doing, adjusting itself step by step along the way. In this atmosphere of uncertainty, it is not surprising that the risk-averse Chinese preferred saving to consuming.

(iii) The Chinese have a natural inclination to save – they honor a traditional culture that emphasizes saving to provide for one's descendants.

(iv) A rigid consumption pattern had been formed in the planned economy era, and continued to be observed. The Chinese are accustomed to living an economical life and many still regard it as a virtue to be hardworking and thrifty.

(v) The growing disparity between urban and rural areas has created a great income gap that hinders the growth of demand for consumption goods. (See pages 23-25, "Social Development")

(vi) The concept of credit is still in its nascent stage in China. Aside from its ideological conflict with tradition, flaws in the credit and monetary systems do not favor increases in consumption.

(vii) A series of reform policies have provided impetus to China's rising savings rate. For example, the policy of birth control has led to an ageing society obligated to spend large sums on providing for the old. Reforms aimed at commercializing housing and medical insurance caused people's real income to decline, while increasing the demand for savings, a large part of which is spent on education. All these factors contribute to the rises in savings and the decrease in current consumption.

Due to insufficient demand for consumption goods, economic growth in China has been driven by industrial investment, which is the immediate cause of high investment rates and excessive penetration. It is worth noting that investment demand is derived from consumption, without which it would loose its foundation of growth. Therefore, economic growth propelled by years of investment will not be sustainable without sufficient demand for consumption goods.

2.3.2 Excessive government intervention and the decline of TFP

An important institutional reason for the decline of total factor productivity is excessive government intervention that plays an important role in the excessive penetration of capital. Because of its incomplete market mechanism, China had to rely on the government for the most important investment initiatives. Investment decision-making still depends to a great extent on the will of government officials, rather than a clearly defined system of responsibility sharing and crosschecking. Consequently, most government projects yield lower economic returns. Motivated by local economic interests, local governments often use regional trade barriers to compete with each other in developing profitable manufacturing industries, resulting in a high degree of redundancy in the construction and expansion of investment projects. Another consequence of government intervention is the large amount of money created by the banking system, as a result of which the scale of lending often exceeds the level planned.

A distinct manifestation of excess government intervention is the convergence of industrial structures across regions. In the planned economy era, the pursuit of independent economic systems by local governments gave rise to over-redundancy of development. Since the reform

started, there has been little progress in economic differentiation across regions or the development of comparative advantages and regional cooperation. Since no laws or norms regulate the economic relations among local governments, regional barriers and protectionism have hindered the smooth flow and allocation of production factors across regions, which in turn have contributed to the convergence of industrial structures.

For example, nearly every province has its own large-scale steel plants and the 18 sets of ethylene equipment are scattered among 15 provinces. Because of redundant development, regional barriers and market segmentation, it is difficult for resources to flow and be efficiently allocated even within the same province. Taking Yunnan Province as an example, there is little differentiation in industrial structure among the different areas of the province. There is, however, much redundant development at a low-level. All its 16 administrative regions produce cement, synthesized wood plates, electricity, beverages, and wine. Raw coal and nonferrous metals are produced in 15 regions; sugar, machine-made paper and paper plates in 14; and chemical fertilizer in 10 regions. All industries, whether basic or critical, suffer from the problems of redundant development at low levels, over-dispersion of capital, and convergence of industrial structure. Most enterprises are too small in size and the degree of industrial concentration too low, for scaled economies to be possible. Excess production capabilities leave large numbers of facilities in state-owned enterprises either standing idle or operating at a low capacity, at less than 40% in over half of the province's manufacturing enterprises.

Due to intervention from local governments, it is rare for enterprises in China to enter into cooperation or investment alliances with those in other provinces. A recent survey of the 800 enterprises that have ever made acquisitions or mergers shows that 86% invested only within the city and 91% only inside the province. This may explain why Chinese enterprises are usually small-scale and why the industries are fragmented. According to a separate study by the State Council, managers of Chinese enterprises believe that Beijing and Shanghai, the two technological and industrial centers under the most political influence in China, are also the most heavily protected. The most protected industries include pharmaceuticals, electronics, electric machinery and transportation equipment. State-owned and private enterprises find themselves more under the impact of protectionism than their foreign-funded counterparts, which indicates that Chinese enterprises are still subject to heavy intervention from their local governments.

III. China's productivity growth: Main sources and obstacles

It is worth pointing out that total factor productivity is a broader concept than physical factor productivity, since it captures not only changes in the comprehensive technological level, but also the effect on economic growth of factors such as the combination and allocation of production factors, management, economic structure and economic system. In this paper, the calculation of TFP growths is based on residual growths attributed to unobservable factors after the changes in factor input have been accounted for. A multitude of factors may, therefore, cause changes in TFP.

Research shows that the main sources of growth for China's total factor productivity include the productive potential released by institutional reforms and the improvement in productive efficiency brought about by the importing of technical know-how. To obtain sustainable TFP growths, nonetheless, China must make more reform efforts to encourage domestic technological innovations, to improve the quality of labor and to modernize its economic structure.

Total factor productivity receives a lot of attention for its contribution to economic growth, especially in transnational comparisons. The growth of TFP is a dynamic process. Both research and experience indicate that there is a change over time in the relative importance of TFP and factor input as the source of economic growth. This balance is also closely associated with the nature of the development stage and the key elements in the growth process. Accumulation of production factors once played a critical role in the industrialization (or the time of rapid economic growth) of today's developed countries. One can imagine that the main content of growth in this stage is the satisfaction of people's basic needs for necessities and infrastructures. These were mostly material-intensive industries with low technological contents. The growth must thus be extensional and must receive little contribution from TFP. China currently finds itself in such a stage. There is rich evidence that TFP accounts for 30%-40% of China's economic growth, while in developed countries over 60% of growth can be attributed to TFP. With capital accumulation, China must go through the transition from a labor-intensive to a capital-intensive economy. Labor-saving technologies can come on line only with sufficient capital accumulation. As the economy expands with capital accumulation, economic growth, as well as the growth of TFP, is bound to slow down. Products with high technological contents will become the driving force behind economic growth, and TFP's share in economic growth will increase. It is unrealistic to believe that this pattern of transition can be broken and that TFP now plays as important a role in China as in developed countries.

In China, the factors that constrain productivity are constantly changing with economic development. Since the reform started, the economy has benefited from the "reform dividends" and the opportunities created by a series of measures that have been taken: rural reforms, the opening up policy, the restructuring of production relationships, property rights reform centered on ownerships, establishment of the socialist market economy and all-encompassing structural innovations. China's immature market mechanism has the benefit of leaving a lot of room for structural innovations to stimulate economic development. However, the stimulus is not as strong as in the early stage of the reform. The key bottleneck for China's economic growth and productivity growth will shift in focus from the constraints posed by the basic economic system to the challenges from specific policies aimed at such areas as "technological progress", "upgrading industrial structures", "further opening up of industry" and "further transformation of the dual economy system." In this new stage of

reforms, China will also pay closer attention to the harmonious development of the economy, society, and the environment. The following is a brief analysis of the main obstacles, and their origins, to increasing total factor productivity in China. It will look at four major aspects of structural reform: technological progress, structure and allocation of production factors, social development, and resource and environmental constraints.

1. Structural reform

Theoretically, institutions and technology are two basic factors that restrict the growth of productivity. Thus, shifting the institutional and the technical frontiers will increase a country's productivity. China's goal with structural reforms is to improve the quality of the economic system and expand the system's frontier, thereby improving productivity.

Since 1978, China has had 25 years of reform. Without any available model to follow, it has taken progressive steps to change the economic system from top to bottom, taking easy steps that are then followed by more difficult reforms. This reform first went through the process of revitalizing the old economy and opening up to the outside world in the 1980s, followed by a further opening up and more formally establishing the socialist market economic system in the 1990s. This process has fundamentally changed the people's way of life in terms of both economic and social survival. China changed from a planned economic system, characterized by high unification and central control, to a market economy system where resource allocation is led by market mechanisms. Through this process it became evident that the planned economy was the institutional cause of low total factor productivity, as reform brought about rapid economic growth and improved TFP. It is important to remember, however, that China's economic system is still far from perfect and that productivity development faces a great deal of systemic obstacles. China is burdened by many remaining challenges in its goal of converting from a planned economy to a market economic system.

1.1 Market reform has provided the necessary structural condition for productivity increases

For over 20 years, China's structural reform has had enormous successes in raising the country's productivity.

For example, market competition, where various types of ownership develop around the center of public ownership, has basically formed in China. Except for a few basic fields that are still monopolized by the state, pricing and resource allocation in most production and service sectors are now determined by market competition. The market mechanism is thus already playing a leading role in resource allocation in the economy. The introduction of the market mechanism has released dynamic economic agents that have enlivened China's economy. The nature of market competition has also facilitated extensive technological innovation, and has also improved productivity. The times of shortages of food and general consumer goods have become history. Housing, education, travel, communication, health care, sports, entertainment and private automobiles are gradually becoming areas of consumption for the average person.

The investment system has also changed significantly. Enterprises have progressively replaced the government as the most important investment agent. The government has almost entirely withdrawn from investing in competitive sectors, focusing instead on areas like infrastructures, environmental protection, urban public utilities, education, pensions, and medical insurance. Blind investment, resource allocation in ineffectual projects, and the amount of soft budget investments have all been reduced. The efficiency of investment has clearly improved. Government regulation and manipulation of macro-economic activities is gradually shifting from direct to indirect measures.

State-owned enterprises are no longer simply production units under a planned economic system, but have become independent agents with self-interests and self-development abilities. As such, problems of inefficiency are decreasing. The percentage of state-owned enterprises in the national economy has, in fact, dropped by a large margin as the scale of the private economy has expanded rapidly. It is estimated that the private economy already accounts for more than 60% of total economic activity. The enormous vigor that the private economy provides is an important source of momentum for China's economic growth.

Banking reform has also made progress in China. Under the planned economy, there were no real commercial banks in China. The People's Bank of China generally monopolized all financial transactions, and banks were used to "centralize collection and allocation of funds by the state." Head offices would check and ratify loans and transactions, leaving lower level banks with almost no autonomy. Throughout the reform, independence in banking was progressively strengthened. In the early 1980s, the People's Bank of China began its transformation into a body that serves the function of financial management of a central bank. A financial system has emerged where the central bank, commercial banks, policy banks, securities broker companies, insurance companies, and rural credit offices coexist and specialize in many different types of financial transactions. In 1998, the central bank and the four major state-owned commercial banks abolished their old branching system based on the administrative division of provinces and cities, replacing it with a new system based on broadly defined districts. This effectively cut the channels through which local governments used to intervene in banking operations, thus creating better external conditions for the commercial banks to operate efficiently and profitably as truly commercialized enterprises.

The leading role that the market mechanism now plays in China's resource allocation has greatly improved efficiency. One important sign is a new trend towards higher average profit rates since the reform (Appendix Table 5). These changes clearly signal a release of productive potentialities.

Box 2: How was market competition introduced in China?

China has adopted a reform process characterized by progressive and incremental adjustments. Gradually increasing the non-state-owned share of the economy, China progressively strengthened the function of the market mechanism. During the initial reform, there was no clear model for China to follow. The reform process is frequently described as "wading across the stream by feeling one's way," to capture the step-by-step fashion in which the government introduced new reform policies. Significant initiatives have included: "regulation by plan combined with regulation by market" (1979), "commercial economy where multiple kinds of ownership are allowed to coexist with public ownership of the means of production" (1980), "regulation by plan as the main tool and regulation by market as a complement" (1982), "planned commercial economy on the foundation of public ownership" (1984), "a planned economy combined with market regulations" (1989), "socialist market economy" (1992), etc.

China's market-based reform started from the Third Plenary Session of the Eleventh Party Central Committee meeting in December of 1978. Since then, its economic reform can be broken into three stages: the starting stage from 1978 - 1984, the exploration stage from 1984 – 1992, and the deepening stage from 1992 until the present.

(1) During the first stage, from 1978 - 1984, while enterprises were given more decision-making power and a number of pilot projects were implemented in cities, the reform was mainly focused on the "family responsibility system," which changed land ownership in the countryside. Before the reform, China's rural economy was founded on collective ownership, "owned in tiers by three parties: the people's commune, the big brigade, and the production brigade." Farmers who worked in the production brigade participated in collective work organizations, earning work points according to the amount of labor they provided. At year's end, bonuses were distributed according to the work points accumulated. Farmers also had land of their own. Unlike in the former Soviet Union, the produce market in China was based in the countryside, on which cities depended for agricultural products. After the reform, the produce market was opened up to the city. At the end of 1978, China began to implement the "family responsibility system" in the countryside, giving individual land contracts to every peasant family, and turning peasants into independent agricultural producers. This shift greatly increased peasant's enthusiasm for production. In 1979, the state was then able to raise the purchasing price of staple agricultural products by a large margin, at an average rate of 24.8%. Thanks to this, the government progressively narrowed the range and quantity of state purchases. By the end of 1984, the state reduced the variety of government purchases from 113 kinds of produce to 38. Additionally, peasants gained the right to run one-person household businesses and engage in individual commerce, service, and trade. They were also able to purchase means of production like machines, tractors, automobiles, agricultural ships, etc. These new policies were a great success. Year-by-year grain yield increased, and there was a notable improvement in peasant life. Enough food was produced to feed the entire country, and the rural economy recovered.

The rapid development of township enterprises also played an important role in transforming China's rural landscape. Before the reform, the predecessor to the township enterprise, known as the commune-brigade, ran enterprises, mainly dealing with agricultural machinery, agricultural produce processing for local consumption, and construction materials, etc. By 1978, the output value of commune-run enterprises accounted for 9% of the total industrial output. After the rural reform, inefficiencies in the system were reduced by the market mechanism of supply and demand, allowing many countryside enterprises to improve. Meanwhile the essential conditions for optimizing production factors in the countryside were created as the rural laborers could now move freely among industrial sectors and regions. Taking this opportunity, combined with advantages over their more slowly reformed state-owned counterparts, township-village enterprises strengthened and developed non-agricultural industries. By 1996, township-village enterprises employed up to 1.3 million people and generated value-added of 1.7 trillion *yuan*, which accounted for 62% of national industrial value added and 26% of GDP. Township-village enterprises have become an example of the strength of the rural economy and a pillar of the national economy.

China's urban reform mainly involves reforming state-owned enterprises, but collectively owned enterprises also play a role in the urban economy. Collectively owned enterprises belong to the public by definition. Their management system is basically the same as that of state-owned enterprises. State-owned enterprises had not been real enterprises, but merely "production units" that met the government's production targets. Purchasing and marketing were monopolized by the government, under its centralized planning policy; profit was distributed by the government. SOEs' operating mechanism was rigid, and thus efficiency was low. Because of this, reform was carried out to "grant more power to SOEs and allow the retention of a larger share of the profits."

This new policy aroused enthusiasm in production and management in state-owned enterprises by increasing their decision-making power and economic incentive. The measures included: apart from meeting government targets, enterprises could make extra production to satisfy the market, and could make independent production plans; within certain limits, enterprises could sell their products in the market at the prices set by the state; the share of goods rationed by the state decreased year by year; and the state and the enterprises shared accountability, using the economic responsibility system, which allowed enterprises a certain degree of financial and economic independence and gave them the power to tie workers' benefits to their performance.

(2) Exploration stage (1984-1991). The success of the rural reform gave confidence to and accelerated the urban economic reform. At the Third Plenary Session of the 12th Party Central Committee meeting, held in October of 1984, the central authorities proposed the formal launch of comprehensive urban economic reforms to replace the planned commodity economy. Thus China began to transfer the majority of economic reforms from the countryside to the city, with reforms of SOEs as the main focus. The largest state-owned enterprise reform involved releasing the government from management duties in enterprises, and properly separating ownership and management. In concrete terms, this meant establishing a contractual management responsibility system, and implementing a rental system in some small-scale state-owned enterprises.

After increasing the decision-making power of enterprises, the main obstacle to further reforms was the distorted price system left over from the planned economy. Without changing distortions in pricing, it would be useless to increase the decision-making power of enterprises. In March 1985, the State Council abolished, for the first time, price controls of means of production used outside the plan. In the history of reforms, this measure was considered the formal start of the two-tiered pricing system. While implementing this two-tiered pricing system, the share of products at controlled prices declined progressively, and, as time went on, commodity prices began approaching the equilibrium prices of the market. The two-tiered system reduced the shock of the price reforms. However, it also caused serious problems of corruption, which is now a major social concern.

In 1987, the 13th Representative Conference of the Communist Party of China formally suggested a shareholding system as a model for the reform of property ownership. Under this policy, the property rights of small-scale state-owned enterprises could be transferred to the collective or individuals at a price. Also enacted were the "Provisional administrative regulations for self-employed entrepreneurs in urban and rural areas", the "Act on enterprises with three types of foreign capital," and the "Interim regulations of private enterprises." Issued in succession, these new laws were intended to protect the non-state-owned economy, offering legal guarantees to non-state-owned enterprises. As a result, the non-state-owned economy achieved a breakthrough in development. From 1984-1991, the average annual rate of industrial output value of the state-run sector was only 8.3%, but that of the non-state-owned sector grew to 23.9%, of which 19.7% was contributed by the collectively owned industry, 45.4% by individually owned industries in urban and rural areas, and 47.3% by other enterprises.

(3) Deepening reform (1992 - present)

From January - February 1992, Deng Xiaoping traveled throughout southern China. In a series of speeches, he laid out the fundamental keys to the development of China's new market economy. In October of the same year, the 14th Representative Conference of the Communist Party of China formally confirmed the socialist market economy system as China's goal for economic reform. They proposed that state-owned enterprises, collectively

owned enterprises, and other types of enterprises should freely compete in the market, allowing the market mechanism to select the efficient over the inefficient. It was decided that state-owned enterprises should play a leading role through fair-play competition. The state should make and implement relevant regulations as soon as possible to transform the shareholding structure and ensure the sound development of state-owned enterprises. So the role of the free market in Chinese enterprises was formally confirmed, and Chinese enterprises entered a comparatively standardized development stage.

In November of 1993, the Third Plenary Session of the 14th Party Central Committee of the Communist Party of China passed the "Decision on several questions about setting up a socialist market economy system by the Central Committee of the Communist Party of China." The committee proposed that, in order for the market to play a basic role in resource allocation under macroeconomic adjustments and controls, the state should create conditions for multiple types of ownership to participate in market competition. Enterprises should be treated equally and state-owned enterprises should be modernized to meet the demands of a market economic system with clearly established property rights, well defined rights and responsibilities, independent management from the government, and sound management practice." From then on, the reform of state-owned enterprise shifted from "granting more decision-making power and economic incentives" to "realizing structural innovations based on marketization." In December of the same year, the National People's Congress passed the "law of firms," which grants equal legal status to companies of all types of ownership.

A core reform of this period was the restructuring of SOEs from state-owned to modern enterprises that rely mainly on a shareholding system. According to the "law of firms", equities of large state-owned enterprises should be held by authorized state departments or investment institutions which, as shareholders, enjoy legal rights proportionate to the number of shares held. The investors cannot withdraw their investments, but can transfer the ownership of shares. As independent market entities, such enterprises no longer depend on the government, and are no longer subject to administrative hierarchies. Managers are no longer regarded as government cadres. Rather, they are hired by the board of directors and can choose which employers they wish to work for. In terms of the accounting system, rules governing accounting and financial management are introduced to meet international standards.

In 1997, the 15th Representative Conference of the Communist Party of China announced that the "non-public economy was an important component of the socialist market economy of our country." The statement was included in the constitutional revisions in 1999. Thus the non-state-owned economy, especially the privately owned economy, was formally confirmed as part of China's economic structure.

In September of 1999, The Fourth Plenary Session of the 15th Party Central Committee passed "The Decision on several important issues of reform and development of state-owned enterprise by the Central Committee of the Communist Party of China," which proposed that state-owned enterprises should promote pluralism in stock ownership, in order to develop companies based upon multiple investment entities and to normalize the structural reform of China's enterprises.

By the end of 2001, the head companies of 73.6%, or 1,994, of the 2,710 corporation groups in the government's pilot project had completed the transition into the company system. Moreover, 82.7%, or 430, of 520 key state-owned and state-controlled enterprises had completed the same process. During this period, structural reform continued for other state-owned enterprises, and rules governing market exit began to be set in motion.

Because of this legal and political endorsement and protection, the non-state-owned economy continues its rapid development. This development not only affects China's growth rate, but also reflects the expanding scope of China's markets. From 1991-2001, the annual growth rate of gross industrial output by state-owned and state-controlled industries was 17.3%, compared to the 24.3% in the non-state-owned economy. If other non-public entities (private businesses, shareholder-owned firms, foreign-funded corporations, and companies financed by Hong Kong, Macao and Taiwan investors) were included, the growth rate would rise to 35%. In 2001, the share of gross industrial output by non-state-owned firms had risen to 78.3%, as compared to 45.8% in 1991. This is an increase of more than 32.5 percentage points, or a growth of 5.51% annually. Non-state-ownership has

permeated into almost all fields of the national economy, even in the sectors that used to be monopolized by the state, such as banking, post, etc.

Over a period of 20 years of reform and development, China's transformation to a market-oriented economy has made significant breakthroughs. The market mechanism now plays a leading role in resources allocation.

1.2 Integration with the world economy provides enormous impetus for China's economic reform

China's opening-up to the outside world provided an enormous impetus not only for its economic development, but also for its broader reforms. Opening up directly increased the scale of foreign trade by large margins. After the opening up, the extent of China's foreign trade increased rapidly from 12.61% in 1980 to 43.9% in 2000, and 60.1% in 2003. A large number of advanced technologies from developed nations were introduced through international trade and became the main source of the country's technological progress. Additionally, the increase in foreign trade provided the economy with simultaneous access to a variety of resources and to two markets, domestic and international. Resources from the international community positively influenced the utilization efficiency of domestic resources and alleviated pressure on China's environment and its own resources. Participation in internationally competitive markets proved an important incentive for Chinese enterprises to improve their competitiveness.

In order to further enjoy the advantages of free trade, in July 1986 China formally demanded a resumption of its status as a contracting party in the General Agreements on Tariffs and Trade. Through the winding course of 15 years, China's desire to enter the WTO was realized in July 2001. Over those 15 years, and especially from the 1990s, China's reform was driven by the opening-up policy. Since joining the WTO, the Chinese government has fulfilled its commitments and followed the rules of the WTO conscientiously. Concurrently, China's market-based reform has accelerated, especially in reducing the government's role in the market.

In the first three years after it joined the World Trade Organization, China has revised more than 2,500 laws and regulations, including laws on foreign capital and foreign trade, while eliminating a large number of inside regulations. In the process of turning WTO rules and agreements into domestic laws and regulations, other areas of reform have also been promoted, including the perfection of the market legal system, the reduction of the government's influence in the market, and the improvement of transparency in the decision-making process. At present, the degree of opening-up of China's economy and liberalization of its trade even exceeds that of some developed countries. China has already become a positive force of trade liberalization in the world, and is giving an important boost to regional liberalization.

Over these years, China has reduced import duties three times and further opened its domestic markets. Its total import and export value has increased by US$ 200 billion each year, essentially doubling its total trade value in three years. The Chinese investment environment has improved, becoming a good place for developed countries to shift their industries. Of the 500 biggest transnational corporations in the world, 450 have investments in China. Receiving a large amount of foreign capital has become the most effective way for China to

obtain technology from developed countries. Foreign direct investment (FDI) not only helps China absorb global knowledge and technological resources, but also creates an enormous and far-reaching influence on Chinese enterprises to improve management by studying and using foreign experience as a model.

1.3 There are still significant restrictions on the economic system that impede improvements in China's productivity

China's market economic system is still immature. Defects in its market economy present the largest obstacles to healthy economic development and productivity improvements. Further reform is needed in almost all facets of the economy, such as ownership composition, the enterprise system, the market system, the financial and credit system, the distribution and social security systems, and macroeconomic controls. With the goal of eliminating bottlenecks to productivity, structural reform is necessary to solve two major contributory problems: first, production factors must be allocated efficiently, and, second, effective incentive and checking mechanisms must be formed.

1.3.1 Factor allocation

China's market economy currently has major defects in factor allocation. Generally speaking, commodity markets are relatively well developed, but the factor market has lagged behind. The capital and labor markets are also facing formidable structural obstacles.

(1) Constraints posed by defects in the capital market

Financing is the basic element for the survival and operation of enterprises. Without an adequate supply of financing, enterprises cannot function normally, much less improve their productivity. Despite their enormous advances since the reform and opening-up, Chinese capital markets still remain relatively undeveloped.

The first problem is that the development of capital markets has lagged behind that of commodity markets. After more than ten years of reform and development, China has created a complete financial system, including banking, equity, bonds, mutual funds, property rights exchanges, etc. Its scale, however, is still very small. For example, only 3.7 trillion *yuan* (equal to US$460 billion) was capitalized on the stock market in 2003. The size of equity financing was only 4.9% of that of bank loans, or 7% if other forms of direct financing are counted.

The slow development of direct financing is mainly due to structural defects in the issuing and exchange systems of the financial market. For example, because of legal loopholes or inadequate supervision, firms engaged in activities against the investors' interests may not be sufficiently punished. This low degree of legalization has restricted the development of China's capital markets

Currently, only the financing function of the capital market as a source of direct financing has been given full play. Its investment and allocative functions have yet to be fully realized. The motivation for the Chinese government to support the development of capital markets is the

need to relieve the pressure of financing for large and medium-sized state-owned enterprises. To issue stocks is a privilege, and a means for enterprises to amass cash. To a certain extent, the stock market is merely a complementary tool to the state banks in financing state-owned enterprises. Moreover, the market is a far cry from a real investment market, and is rather an arena of speculation. Investors get only meager dividends by holding shares over the long term. Instead, they expect to profit from price fluctuations by speculating in the market, from which, ironically, most have lost money. Over the last ten years, stock owners have invested over 2 trillion *yuan* in the stock market, over half of which has been lost.

Another problem with the financial market is the over-reliance on indirect financing. The poorly developed capital market has forced firms to rely on banks for financing, increasing the risk level in the banking sector. It is common for banks in China to deny loans because of a justifiable fear of bad debts. The Chinese banking system is still largely monopolized by the state banks who face little real competition. The government strictly controls entry to the banking market. Assets of the four major state commercial banks account for nearly 90% of the country's total financial assets, and their lending for 70% of total outstanding loans. Because of their long-held monopoly, state commercial banks lack the incentive to increase efficiency. On the other hand, under heavy government intervention, their lending policy still operates in a planned administrative fashion. Because of low managerial skills, a large amount of funds sits idle in the banks' coffers while many enterprises are short of financing, leading to a low service efficiency of capital. Paradoxically, China is an importer, rather than an exporter, of capital. It is the largest recipient of foreign direct investment (FDI) in the world. This paradox proves that the link between domestic saving and domestic investment is half broken. If it were not, these projects would be financed by domestic capital. It is safe to assert that a large part of the profits earned by foreign capital in China could be attributed to the efficiency loss of China's banking system.

In China, large financing discrepancies exist between urban and rural areas, and between firms of different types of ownerships. The allocative efficiency of capital is low. The non-state-owned sector has created 60% of China's GDP, but still struggles to receive financial support, receiving only 20% of financial resources. And while China's agricultural GDP accounts for 14% of national GDP, and the output value of township enterprises accounts for about 1/3 of total national industrial output, loans to agricultural and township enterprises account for only 5% of the total balance.

Additionally, there are too few small and medium-sized financial institutions in China to satisfy the financial needs of small enterprises. Because large banks are much more willing to grant loans and provide services to big customers, China's small and medium-sized enterprises are in want of a good financing environment. This directly obstructs their technological progress and improvements in their efficiency.

It is also important to note the enormous amount of non-performing loans in the state banks, which presents a serious potential risk. Loans by state banks flow mainly into state-owned enterprises, which, however, have large amounts of non-performing assets because of poor economic returns. By the end of 2002, the proportion of non-performing loans of the four major state banks was roughly 25%, a level rarely seen in the world. The huge amount of bad loans in China's state banks has become a serious threat to the country's steady long-term development. However, thanks to a high deposit rate, the four state commercial banks can still operate while bearing the heavy burden of non-performing loans. There is a continual

inflow of private funds to these banks. If the deposit rate drops and if the banking system still runs at low level of efficiency, the financial system will eventually be thrown into chaos.

Yet another reason for China's low investment efficiency is that there remains a serious lack of distinction between the role of the government and that of enterprises in making investment and financing decisions. The "examination and approval system" for investment projects, set up in the planned economy, is still in full force. Since the reform, firms have acquired a certain degree of independence in investing and financing. On the whole, however, the government still controls the decision-making process of most state-owned enterprises. The only real change is that most of the "examination and approval" process has been decentralized and transferred from the central to local governments. This system is not conducive to increasing the firms' ability to act as investment agents or efficiently allocate resources according to the rules of the market.

In addition, the problems in the planned economy where there is extensive government investment has not been sufficiently addressed. Since the reform started, fundamental changes have been made to decrease the government's regulation and control of economic activities, but its role in investment and management has not been effectively altered.

Industries that should be receiving financing from the private sector, like general processing, still obtain extensive government support, while investment in public sectors like infrastructure, social security, primary education, and other public services that should be guaranteed by the government, is often insufficient. This translates into a distorted investment structure, reducing the returns to investment and impeding the development of the public sector.

Moreover, though it is an important part of the reform to separate the government from firms, there is still much confusion between its role of investor and that of manager in the area of state-sponsored investment. As an investor, the government must supervise, rather than directly intervene in, the firms' operations. The current lack of distinction between the functions of the government and those of the enterprises inhibits the introduction of market mechanisms and the increase of investment returns.

Frankly speaking, the democratization of government investments and other decision-making processes are still in their initial stage in China. Inside the government, there is less restraint of responsibility and little sense of risk. Outside the government, essential democratic supervision is missing, and there is usually no specific individual or department who can be held responsible or liable for a government project. Nominally, responsibility is collectively held. In fact, however, nobody is in charge. As a result, constraints of the responsibility system for government investment or financing are weakened, giving rise to high failure rates and low returns to government projects.

The main purpose of the "Law on Administrative Approvals", effective from July 2004, is to change the system of approval to that of registration. Under the new law, the state will stop approving investment projects by enterprises that do not involve government funds. Approvals will still be granted to large or restricted projects, however, out of consideration for the public interest. With the abolition of the approval system, the entry threshold will be lowered for all industries, thus facilitating market competition. This measure will certainly strengthen the status of enterprises in making independent investment decisions and will normalize the government's investment behavior, leveling the market for firms of different

types of ownership. Moreover, the allocative function of the market will be improved, as a result of which efficient allocation of production factors will increase the returns to investment and promote the growth of total factor productivity.

Structural reforms of the investment and financing system involve complicated issues like transforming the role of the state, effective supervision over the government, and perfecting the democratic system. Notwithstanding relevant laws already in place, China still has a long way to go.

(2) Constraints posed by defects in the labor market

China has abundant human resources in its population of over 1.3 billion people, the largest in the world. Such a population is both a heavy burden and an enormous reservoir of resources for economic development. Over the past 25 years, the fast growth of China's economy benefited considerably from its low-cost human resources. The employment of human resources, however, is not yet efficient. Because of structural defects, China has yet to set up a unified and fair labor market. Employment discrimination and the immobility of the workforce are serious problems.

Over the last 25 years, laws regulating the migration of Chinese citizens have been relaxed, especially regarding farmers moving into cities as temporary laborers. On the whole, the mobility of the workforce has improved considerably. There is a sufficient supply of cheap labor for the economic development of cities and advanced regions. However, obstacles still exist for the flow of labor between rural and urban areas, and among sectors of different types of ownership. Despite intensified reform efforts, the household registration system, along with its related polices, such as employment benefits and schooling, still have large adverse effects on the migration of labor among regions. Moreover, since the social security system does not yet cover all sectors of the economy, a great many non-public economic organizations are excluded from the institutionalized network of social security, obstructing the flow of labor among sectors of different types of ownership.

To maintain employment, some local governments adopt disguised policies to repel and discriminate against non-local workers. Examples include a complex net of fees and restrictions to entry aimed at increasing the cost of migrating, regulations explicitly excluding non-local workers from certain jobs, and carrot-and-stick policies, usually in the name of re-employment projects, intended to induce firms to replace non-local workers with the local unemployed. All these measures have hindered the free flow of labor.

These obstacles lower the scope of competition in the labor market, adversely affecting the allocation of human resources. As such, they slow down progress towards narrowing the gap between rural and urban areas, and towards extending urbanization and improving the economic conditions of China's backward countryside. Without fundamental institutional changes, it is difficult for excess labor to move out of the countryside. Improvement in total factor productivity will, therefore, be improbable despite the spread of agricultural technologies.

1.3.2 On the formation of effective incentive and restraint mechanisms

(1) Promoting the reform of state-owned enterprises

Under the planned economic system, enterprises were merely factories or workshops under government control, rather than genuine enterprises. Since the late 1970s, state-owned enterprises have gone through successive stages of reforms, which include "granting SOEs more decision-making power and allowing them to keep a larger share of the profits," "switching from submissions of profits to taxation", and "pursuing a contractual management responsibility system and setting up a modern enterprise system." China is presently developing a new mixed economy that includes public, collective, and private ownerships. It is also striving to make the shareholding system the major form of public ownership.
The reform of SOEs, however, is still very difficult,, for several reasons.

Although most state-owned enterprises have been transformed into firms, large disparities still remain between them and what is demanded by the modern enterprise structure. To various degrees, the government still intervenes in the business of state-owned enterprises.

The corporate governance structure is far from perfect, and many enterprises have not yet set up boards of directors, retaining instead the general manager responsibility system. Even where SOEs have a board of directors and a board of supervisors, it is difficult for the boards to participate in the decision-making and supervision process because of insider control. In many enterprises, defective personnel and distribution systems fail to solve the problem of egalitarianism.

Monopoly is another outstanding problem for China's state-owned enterprises, especially in public utility industries, such as communications, transportation, water supply, electricity, telecommunication, postal service, or in restricted industries like tobacco, salt, petroleum, and insurance. Firms in these areas are protected by state sanctioned monopolies and enjoy fat profits at the expense of consumers. Meanwhile, these monopolized industries are characterized by high wages and wasteful consumption. The consequences are both social injustice and a lack of incentive for the monopolized industries to improve the quality of their products and services. It is therefore important for the reforms of SOEs to break up monopolies, to strengthen government regulation, and to improve the level of competitiveness and efficiency.

In the face of fierce competition, SOEs carry heavy historical burdens. It is estimated that nearly 1/3 of their staff is redundant. A large number of workers have been laid off since the 1990s, about 500,000 of whom remain unemployed today. It is a challenge for the SOEs to increase efficiency without laying off too many workers. Moreover, the SOEs are still under a multitude of social obligations. Reform efforts have made little progress towards ridding SOEs of their social responsibilities, especially for enterprises owned by the central government. Large quantities of non-performing loans and bad assets, another legacy of the planned economy, add to the burdens shouldered by SOEs. Statistics show that the book value of non-performing assets accounts for 11% of all SOE assets in China. The real figure may well be much higher.

There are many difficulties in trying to adjust the overall structure of SOEs. Apart from their dominance in industries related to national security, both strategic and economic, or

characterized by a natural monopoly, advanced technologies and the provision of important public goods, SOEs still enjoy a strong presence in other sectors. For example, there are a large number of SOEs in the mining industry, and which are on the verge of bankruptcy. It is difficult for these enterprises to exit the market because of imperfections in the social security system, limited government financial resources and a general inability to write off bad bank loans. As a result, adjusting the overall structure of SOEs will be a long and difficult process.

(2) Establishing market-based economic order

A fair and well-ordered market is essential if enterprises are to improve their competitiveness. Both the government and the legislature have designed many policies favorable to facilitating fair competition and regulating economic order. Their implementation, however, will be a time-consuming process.

China's market economy system, which began to take shape in the 1990s, is far from mature. Many economic players engage in irregular activities, and the market and the legal systems are incomplete. Disorders are prevalent in every sector, be it production, construction, circulation, taxation, or finance. There is an urgent need for improvements in the legal, structural and policy environment associated with the market-oriented reform.

With the progress of marketization, the allocating systems for materials and capital formed in the planned economy are gradually disappearing, drastically reducing the scope of rent-seeking for government officials. However, corruptive behavior is rampant in public sectors run by the government. In tax collection, justice, law enforcement, land management, environmental protection and technical supervision, there are a plethora of instances of power abuses and laws broken by officials. There is little transparency in the policy and legal systems. Because of problems of inefficiency and injustice in judiciary, law enforcement and government supervision, there is no prompt and fair resolution of economic disputes, and the healthy development of the market is consequently impaired.

In addition, regional protectionism and monopolies are common, and the negative impact of these on economic efficiency cannot be ignored. Illegal activities like tax evasion, smuggling, and so on are rampant. Fake goods and forged commodities flood the market, commercial swindlers abound, and intellectual property rights of computer software are often violated. The sale of fake food, medicines and agricultural materials endanger public interests, sometimes even people's lives. The natural inclination of people to consume and to invest are thus suppressed.

Unconstrained drives for profit are the main culprit for the disorders from which China has suffered in its transition period. Deepening the reform is the only solution. The government has an undeniable responsibility for establishing and maintaining an orderly market. However, China is a country of thousands of years of experience of rule by individual wills instead of laws. It is also the world's largest developing country with a per capita GDP of only $1,000. One can only speculate how difficult it is for such a country to complete the revolutionary transition to an economic system founded on laws and credit.

In summary, these negative factors notwithstanding, the rapid economic growth and improvements in productivity in China since the reform have benefited considerably from the

so-called "reform dividends," which, we believe, will continue to make large contributions as the reform deepens and the market economic system matures.

2. Technological progress

According to Solow's famous model of economic development, growths in TFP are the indicator of technological progress. Here, technology is taken in an economic rather than technical sense. Results from UNIDO's 15-country productivity study show that from 1962 to 2000, China's technological progress proceeded in two stages: the pre-reform (1960s -1970s) and the post-reform periods (1980s-1990s).

Except in a few years, the technological level showed a downward trend before the reform and a continual ascension after it (see Table 1 in Appendix). Negative technological progress in the planned economy implied that China's economic growth was entirely dependent on excessive investment. In Stage II, the significant transformation of technological progress was a reflection of the enormous changes that were taking place in the production of technology, which had become the major support for development. Market-oriented reforms played a decisive role in changing the nature of China's economic growth. After 1993, the rate of technological progress was as high as 9.6%, exceeding the growth rate of 6.97% for GDP (see Table 1). Technological progress now plays an enormous role in China's economic growth and has created substantial room for future development.

Since the reform, it has helped China make remarkable achievements in its industrialization process. As a developing country, China's technological progress relies to a great extent on imitating and importing from developed countries. The imported technologies are then transformed, digested and absorbed to fit China's economic conditions. Although China still lags considerably behind the developed countries in advanced technologies, gaps in other areas, especially comprehensive production technologies, are constantly shrinking. The room for further imports of technologies is getting smaller. Independent innovation will play an increasingly important role in China's development. How to strengthen China's capacity for independent innovation will therefore become a critical issue.

2.1 The import, digestion, absorption, and transformation of technologies

On its birth in 1949, the People's Republic of China had a blank page on industrialization. With the help of the former Soviet Union and other countries, it began to establish its own manufacturing industries in the 1950s. When relations with Russia soured at the end of the 1950s, the source of technological progress was cut off. From the 1960s to immediately before the reform, China relied entirely on itself to set up a complete national industrial and economic system. In order to speed up economic development and to reduce the technology gap, it introduced a small number of technologies from developed countries, mainly "hard technologies", like sets of equipment and other important machinery. The amount of "soft technologies" imported, such as patents, exclusively held technology and industrial designs, was small. Relative to patented technologies, machinery equipment can be quickly turned into production capacities with little risk involved. However, in some industrial sectors it has led to a widening of technological gaps with the developed countries.

The accelerated process of globalization has commercialized the transfer and exchange of technologies among nations. The more the market becomes a buyers' market, the greater the opportunities for developing countries to find suitable technologies. This is exactly how China has succeeded in introducing large amounts of technology since the reform started. This process has the several properties, presented below.

(1) The proportion of "soft technologies" imported has been on the rise. In the early days of the reform, China concentrated on introducing sets of equipment and important machinery, spending over 60% (67.9% in 1982) of its expenditure for technology trade on them. However, this pattern has been changing with the development and reform of the economy. In 2001, the proportion of soft technologies, such as exclusively-held and patented technologies, technological consultation and technological services, was 63. 06%, while that of hardware was 36.94% only. In addition, new means of import, like transmission through the Internet, have emerged with the development of information technology. This is evidence of the remarkable progress China's manufacturing industries have made. It also demonstrates the significant development of the country's ability to digest and absorb advanced foreign technologies.

(2) From the 1990s, and especially in the second half of the decade, foreign direct investment (FDI) increased considerably (see Appendix). Large multinational corporations have followed each other to set up plants in China. With the improvement in China's investment environment after its entry into the WTO, increasing numbers of multinational corporations have shifted their investment focus to China and have intensified the internal transfer of technologies to the country. Things have changed a lot since the 1980s, when most investment came from the Hong Kong and Taiwan regions. Currently, half the goods China exports are produced by foreign-funded companies. FDI has enormously increased the level of manufacturing technology in China.

(3) Since the reform started, China's manufacturing capacity has expanded considerably thanks to the massive transfer of manufacturing technologies from developed countries and their spread in China. The machinery manufacturing industry has made remarkable progress in the domestication of research on heavy equipment, such as large gas turbines, special-purpose boilers, and power transmission and transformation equipment. China's industrial evolution has led to the development of high value-added technologies, especially in the coastal areas since the late 1990s. Significant increases in the capacity for independent innovations have brought rapid growth to industries like home appliances, communication and IT. Moreover, the number of patent applications has increased considerably, from 14,372 in 1985 to 252,631 in 2002. China has entered the rank of big countries in patent applications, next only to Japan and Germany.

2.2 Natural resource endowment and technological selection

The characteristics of China's dual economy are brought about by pressure from its population. On one hand, it has the largest population in the world, with an enormous excess workforce that has provided an almost infinite supply of labor for its industrialization. However, this has also brought an immense pressure of employment. Thanks to its endowment, China can continue to benefit from cheap labor well into the future. This has also defined the reliance of China's industrialization process on labor-intensive industries. On the other hand, China, as a developing country, must depend on transfers from developed

countries for its technological progress. Most technologies imported from developed countries, nonetheless, are capital-intensive because, again, of resource endowment. The economic logic of technological progress is to replace labor with capital to obtain productivity. "Labor-intensive", however, usually implies a low technological level.

Reality forces China to be inclusive in its selection of technologies. Of the two criteria for this selection, advanced technology and economic returns, the latter is the more important. Under the precondition of economic returns, technologies that fit China's economic strengths must be selected. Cutting-edge technologies, important as they are, should not be pursued in all cases. Likewise, labor-intensive technologies must not dominate in the name of employment policies. The principle of "efficiency with an eye for equity" must be respected, allowing for a certain amount of unemployment. The rapid growth of unemployment in China is just the result of this technological selection. As a response, the country must make greater efforts to establish a social security system.

If full employment is a policy goal, China's technological level must be decreased. In the pre-reform period (1962-1978), China's population increased rapidly at an annual rate of 2.26%.

The government was obliged to maintain full employment of urban residents. The result was a widespread adoption of labor-intensive technologies. This offers a possible explanation for the negative growths of technological progress and TFP before the reform (see Table 1).

Pluralistic technological selection also implies the need for China to develop its own high technology industry. Developing vanguard technologies is the only way towards advanced, high value-added industrialization and an extension of the scope of the market. It also involves substantial costs and risks. Compared with developed countries, China has the advantage of low-cost human capital, which creates sufficient room for the market to absorb the R&D cost of cutting-edge technologies. There is also an urgent demand for technologies that can relieve the country's resource and environmental pressure. Since the mid 1990s, China has made gigantic steps in developing advanced technologies, such as space, aviation, nuclear energy, electronics, telecommunication and bio-engineering., A number of Chinese firms have, in fact, come to occupy a leading international position for their research capabilities and competitiveness. The combined contribution of hi-tech industries to the added value created by the manufacturing sector was 10% in 2002, a modest increase from the level of 6.2% in 1995. Hi-tech industries, however, are yet far from mature because of their low R&D intensity and little technological concentration. Moreover, China owns few intellectual property rights, the development of which relies overly on foreign capital and whose competitiveness is very weak internationally.

China's dual economy is another reason for the need for pluralistic selection. In China, cutting-edge technologies coexist with myriads of other technologies of low efficiency, poor quality, high energy consumption and severe environmental consequences. The reason is not low substitutability. Rather, it is that there are substantial disparities among different regions in the vast reaches of China, in terms of income, socio-economic development, management level and quality of human capital. These disparities are the direct cause of the multiplicity in the supply of, and the demand for, quality of goods and services.

2.3 Capacity for independent innovation and future development

In the planned economic system, the government was the main body to promote technological progress, while firms lacked proper incentives for innovation. After the reform, firms, reinvigorated by the introduction of market competition, began to become more actively involved in technological innovation. Enterprises started to overtake the state as the main driving force for technological development. From the 1990s, China's expenditure on R&D increased steadily, its rate of GDP increasing from 0.6% in 1996 to 1.23% in 2002. During the same period, the proportion of R&D investment made by firms increased from 43.3% to 61.2%, which indicates that a mechanism for independent innovation had taken shape. A number of firms grew from copying and imitating to independently developing new technologies.

Nevertheless, China's technological progress still has formidable hurdles to overcome. Most firms are on a low technological level. Small in scale and low in profits, they are falling far behind the world's largest corporations. In the wave of globalization, in which a large number of multinational corporations have swarmed into China, Chinese firms face the threat of marginalization in the latest round of global exchanges and specialization, unless they make an earnest effort to grow to be competitive.

Chinese firms have little capacity for independent technological innovation, in that they own few intellectual property rights and rely on foreigners for important large equipment. The essential technologies used in industries of huge production capacities, such as IT and telecommunications, are all in foreign ownership. The technological gap between China and developed countries will widen unless Chinese firms are able to increase their core competitiveness through independent innovation.

Insufficient technological innovation in China is associated with structural defects in the economy as well as its low level of development.

On the one hand, China finds itself in a period of rapid growth characteristic of the intermediate stage of industrialization. The main areas of development are basic consumer goods, housing, infrastructures like roads, railways, construction and bridges, and products of the heavy and chemical industries, all of which are material-intensive with low technological content. Helped by high demands for their products, firms have few incentives to innovate. Moreover, technologies use in these industries could easily be imported.

On the other hand, China is a transitional economy that has not established a mature and stable property rights system for its firms. Successfully put to practice in multinational corporations, new management theories, management modes and competitive rules answering the needs of massive socialized production have become the latest international norms and standards. The governance structure of Chinese enterprises, however, has failed to develop in line with these. Institutional and systemic obstacles have severely restricted the improvement of the firms' capacity for independent innovation.

Common among Chinese managers is a deplorable lack of plans and strategies for the long-term development of their enterprises. Nor is there a sufficient incentive for sustaining technological innovation over the long-term. The pursuit of short-term returns is still the dominating motivation for importing industrial technologies. This is precisely the reason why Chinese firms are inclined to purchase complete suites of manufactured equipment, such as

production lines. Although China has recently begun to import more "soft technologies" and to restrict the introduction of equipment with licenses, the lack of forward-seeing strategies and incentives for innovation is still the weakest link for Chinese enterprises.

Over the past decade, expenditure on digesting, absorbing and transforming imported facilities has been less than 10% of the total spent on technological importation by large and medium-sized enterprises. The average figure for OECD countries is 33%. China's practice has also been different from other Asian countries, such as South Korea and Japan in the 1970s and 1980s when they invested two to three times as much in absorbing and localizing imported technologies as in actually purchasing foreign equipment.

The minute size of most Chinese firms is another reason for their over-reliance on buying "hard technologies." A study of 37 manufacturing industries shows that, in those with large amounts of foreign investment, such as pharmaceuticals, electronics, automobiles, chemical tools and home appliances, the concentration ratios of the four largest firms are 6.44%, 8.13%, 16.92%, 1.73%, and 14.01% respectively. In developed countries, as a comparison, the four leading companies in these industries control over 50% of the market. A scattered industrial structure is unfavorable to domestic technological innovation. Nor is it favorable to the spread among their Chinese competitors of new technologies introduced by multinational firms.

Insufficient protection of intellectual properties presents another hindrance to improving the capacity for independent innovation. For over 20 years, China's intellectual property rights system has covered the distance that it took some countries one to two centuries to complete. Now, China has formed a complete legal and law enforcement system in accordance with international standards, and has set up a two-pronged safeguard model consisting of the administration and the justice departments. Through the efforts of many years, remarkable advances have been made in the recognition of intellectual property rights. It has not been easy for China, a developing country, to accomplish this in such a short time.

However, much evidence still exists of insufficient protection of intellectual properties. For instance, Chinese firms selling popular brands in the domestic market often see their trademarks violated by copycats abetted by regional protectionism. These firms are thus prevented from growing large enough to compete with their international rivals. Moreover, piracy has forced Chinese software developers to give up independent research and turn instead to earning commission fees by redeveloping and customizing products for foreign firms. A number of inventors, writers, musicians, and enterprises with famous brands, which account for only a fraction of the Chinese market, believe that China's intellectual property system is severely limited in providing sufficient protection for their interests.

The question of whether we can speedily address the lack of technological innovation has an immediate bearing upon the upgrading of China's industrial structure and the promotion of a competitive, sustainable and fast-growing economy in the country.

Box 3 Establishing a balanced protection system for intellectual property rights

Quite a lot of people think that China actually has too much protection for intellectual properties. Particularly after it joined the WTO, lawsuits, or threats of lawsuits, filed by foreigners who own intellectual property rights in China, began to increase dramatically. Another popular view is that the new intellectual property rights law, revised according to the requirements of the WTO, "exceeds the level of China's economic development." It holds that what the government should be concerned about is the abuse of intellectual property rights. Using the monopoly status granted by property rights to obstruct market competition is at least as unacceptable as violating the rights. For example, when some Chinese producers of DVDs introduced the relevant technology and production lines, the firms owning the technology, namely the 6Cs[5], did not ask for patent fees. It was only after the Chinese firms had created a vibrant domestic market that the foreign companies seemed to have suddenly "recalled" their patent rights. Apparently, their action was reasonable. In fact, however, the 6C's could be suspected, at least, of failing the principle of sincerity and of abusing their rights.

The purpose of protecting intellectual property rights is to encourage invention and innovation, to promote the wide application of knowledge and technology, and to improve social efficiency. However, the monopoly created by property rights may raise transaction costs, which may in turn reduce social efficiency and even limit the spread of knowledge and technology. Debates will continue to be waged about the advantages and disadvantages of this system. Those who opposed establishing a patent system in China in the early 1980s still believe that the system will overly restrict the firms' ability to learn by imitating and duplicating, a restriction which is disadvantageous for economic development. Admittedly, the modeling and duplicating behavior of some Chinese enterprises once provided remarkable impetus to growth in China's economy and productivity.

Take the "Wenzhou model" as an example. Wenzhou of Zhejiang Province is well known for its private economy. It was once a synonym for production bases for fake products. People used to marvel at the abilities of Wenzhou producers to imitate and to adjust rapidly to the market. Nowadays, in the global market, however, "made in Wenzhou" is being gradually replaced by "created in Wenzhou." The course of development for Wenzhou should help us gain a clearer understanding of the complexity of the advantages and disadvantages of the patent system.

In a word, an intellectual property system must maintain a delicate balance between protecting property rights and safeguarding market competition. We must prudently define the boundary of the range of protection and prevent abuses of rights, while confirming the necessity and importance of such protection. It is a challenge not only for China, but for the entire world. China still has a long way to go towards setting up a well-balanced protection system for intellectual property rights.

[5] 6Cs refers to the 6 multinational corporations which united to put forward a requirement for patent fees to the Chinese firms.

Box 4 China's strategy of "exchanging markets for technologies"

China is both a big exporter and an importer. It is more open than most of its trading partners in Asia. Unlike Japan and South Korea, which have resisted importing goods and investments from developed countries for a long time, China is a huge and open market for the products of developed countries. For example, though total exports by the U.S. have increased very slowly in recent years, its exports to China have grown by three times over the past ten years. In particular, China has become the biggest market for America's hi-tech products. According to data issued by the U.S. government, the space industry sold $2 billion worth of products to China in 2003, about 5% of its total exports, or nearly the same as the share exported to Germany. In the same year, American firms sold $500 million worth of advanced production equipment to China, exceeding the amount to France. The value of semiconductors that American computer-chip manufacturers exported to China was $2.4 billion, equal to that to Japan.

China allows foreign-funded enterprises to invest in its market on a scale larger than ever before. Since 1978, it has imported more than $500 billion in foreign investments (see Appendix Table 9), which is 10 times the foreign capital Japan imported between 1945 and 2000. It is evident from its degree of opening up that China does not make as much effort to protect domestic enterprises as Japan and South Korea did. On the contrary, it has allowed foreign companies from the U.S. and other countries to discover and exploit new markets, especially for products of high added value, such as airborne vehicles, software, industrial design, advanced machinery and spare parts like semiconductors and integrated circuits.

Why is China so open? The answer lies in its strategy of "exchanging markets for technologies." Since the reform started, accelerating economic development has created a huge demand for imported technologies. The strategy of technological imports has been changing. From years of practice, Chinese authorities have come to the conclusion that, to introduce advanced technologies, it is not enough to rely on domestic enterprises purchasing or leasing technologies from abroad. Technical know-how embedded in direct investment is a more efficient choice. The demands for soft technologies (e.g. designs, manufacturing skills, craftsmanship and management) and advanced technologies by Chinese firms are better satisfied in joint ventures with foreign investors. This also helps to avoid redundant introduction and to raise the domestic technological level.

The prerequisite for attracting foreign investment is to open up the domestic market. China has, therefore, carried out the policy of "exchanging markets for technologies", namely, of continually expanding market opening, attracting more foreign investment and introducing more advanced technologies. President Jiang Zemin pointed out in the preamble of "*The Basics of the Utilization of Foreign Capital in China*" (1995): "China's purpose in absorbing and utilizing foreign capital is to give full play to its comparative advantages in market size, resource and labor force, to absorb external financing and technologies, to promote the development of productivity of Chinese society, and to increase the quality and returns of China's economic growth."

As a result, a pluralistic state has been formed in China's technological imports, including domestic enterprises purchasing technologies, the state using proceeds from sales of government bonds to introduce technologies, and foreign-funded firms bringing in technologies, with the last channel playing an increasingly important role in terms of the scale, quantity, level and effect of technological imports.

In 2002, foreign-funded enterprises signed 3,471 contracts for technological imports, with a contract value of $13.485 billion, accounting for 77.58% of the national total. State-owned enterprises were also active, signing 1,741 contracts valued at $3.036 billion, or 17.76% of the national value.

China's investment environment has been significantly improved since its entry into the WTO. An increasing number of multinational corporations are strengthening internal technological transfers by shifting their investment focus to China. In 2002, more than 45% of technological imports took the form of internal transfers. Companies including Motorola, Nokia, Ericsson, Sony, Hewlett-Packard, Samsung and Philip were among the most active.

Most technological imports in China take place in the electrics and information technology industries. Other major importers include metallurgy, transportation, chemical engineering and

energies. In 2002, for instance, the electric and telecommunication equipment industry ranked among the foremost in China in both the number of contracts and the contract value in terms of technological introduction. The value of technology-related contracts was $9.636 billion, 55.41% of that of all contracts. This provides evidence of the re-organization and competitive allocation of IT resources throughout the world. World famous IT companies have been shifting their production bases overseas, concentrating instead on R&D, sales and services.

China's strategy of "exchanging markets for technologies" has proved a modest success. In the first decade of the reform, it introduced technologies mainly through purchases by domestic enterprises. Nowadays, the main bodies bringing in technological imports are joint ventures and other foreign-invested enterprises. Multinational corporations have, in recent years, set up more than 400 R&D centres in China. With the growth of industrial chains throughout the country, industrial concentration is gradually taking shape.

However, the strategy has failed to realize all that was expected of it. In the past decade of implementation, it has played a positive role in obtaining low-end technological products and advancing China's technological and production levels, at least in the short run. In return, however, foreign-invested firms have gained enormous market shares, enjoying a monopolizing position in some industries. Chinese enterprises, on the other hand, have not been able to receive key and advanced technologies, while their capacity for independent innovation has made little progress. The result is a heavy reliance on foreign companies in certain industries.

Currently, foreigners control most of the key technologies, brands and sales channels in the manufacturing bases transferred to China. Their Chinese partners, on the other hand, scramble for meager profits at the lower end of the global production chain.

3. Structure and factor allocation

China's economic growth is driven by investment. This can be rationalized under both the planned economic system before the reform and the market economic system after the reform. Of course, the reasons and historical background are different in different periods. Before the reform, the rapid growth and soft budgets pursued were important structural factors that drove investment. They have, however, been considerably weakened in the post-reform period. The pre-reform model for investment-driven growth is hard to maintain. What has created long-lasting investment-driven growth after the reform is the increase in capital efficiency brought about by market-based reforms and changes in the economic structure.
Development economists pay close attention to how China's changing economic structure has generated increases in economic efficiency. After studying the economic performance of China and Russia in the transitional period, Sachs proposed that the high growth in China is not the result of institutional changes but of its fast evolving dual economy. In other words, the upgrading of its industrial structure created in the evolution of the dual economy is the core source of China's economic growth.

However, it should be noted that China is still in the course of economic transition and still has a long way to go before the transition is completed. The dual economic structure has significant negative effects on productivity.

An abnormal structure in the course of modernization for developing countries, the dual economy is manifested in China by the coexistence of modern and traditional industries in urban areas, and by the cohabitation of traditional farming with modern agriculture represented by township enterprises in rural areas. There is little connection between the different levels. China's special dual structure has produced a series of negative effects on economic development, such as separation of the urban and rural economic systems and

insufficient domestic demand. All these have had an adverse impact on productivity. It is a remarkable phenomenon in today's China that urban-rural separation has caused the industrial structures in urban and rural areas to converge. The convergence of industrial structure and the homogeneity of products have resulted in excessive and unordered competition, hampering efficient resource allocation and slowing down the development of social division and specialization. It has also led to an extensional type of industrial growth characterized by increases in the capital-output ratio. In addition, the urban-rural separation prevents various factors such as population, capital, goods and materials, information and technologies from flowing from urban to rural areas. Urban civilization cannot be spread to the countryside, and this hinders the process of urbanization. Moreover, the cities' ability to absorb labor has weakened with the slow-down of the development of modern economic sectors like the service industries. Meanwhile, productivity increases in agricultural production have created excessive labor that is difficult to transfer elsewhere.

In 2003, with a per capita GDP of $1,000, the Chinese economy entered what is recognized in the world as the period of accelerating growth. In this period, industrialization and urbanization, accompanied by adjustments in the economic and capital allocation structures, will be the two big engines of growth.

3.1 Economic returns and productivity

Since the start of the reform, some interesting changes have taken place in the Chinese economy. For example, despite increases in productivity, economic returns to firms have decreased relative to the pre-reform level. China's industrial productivity improved significantly between the 1980s and the mid 1990s, at an average rate of 2.62% per year (Jefferson, 2000), but industrial economic returns declined by a substantial margin. The pre-tax profit rate of capital for firms with independent financial accounts dropped from 25.06% in 1980 to 12.20% in 1990 and then to 6.92% in 1997. These continual decreases are in stark contrast to earlier expectations of increasing economic returns, calling the reform's results into question. China made little technological progress in the 1980s and early 1990s (see Table 1). In such a situation, it is normal for the average profit rate to decrease in a free market economy. The coincidence of this decrease with increasing productivity proves that the reform was effective in enhancing the role of the market in resource allocation.

Under the planned economic system, the high profits enjoyed by China's industrial sector were surplus transferred from other sectors, in particular agriculture, and from consumers on the strength of the state monopoly over production and pricing. With the introduction of the market mechanism, the government has gradually relaxed its control over market entry and pricing, and this has considerably reduced the number of opportunities for monopoly profits in most industrial sectors. In a market with limited capacity, keen competition is the direct cause of declining profit rates. Undoubtedly, this will impel firms to improve management, productivity and resource allocation.

While the average declines, the distribution of profit rates in China is becoming less scattered. It is clear from Table 6 in the Appendix that disparities among different sectors in the profit and tax rate of capital for firms with independent financial accounts have been decreasing since the reform started. This proves from another perspective that the reform has improved resource allocation. In the planned economy, the lack of competition, incentives or information caused by state monopoly impaired resource allocation and resulted in wide

profit gaps among different sectors. With the introduction of market mechanisms, product prices began to be determined by the market. Moreover, investors other than the state had entered the market, increasing the share of profit-seeking investment. Profit-seeking capital is bound to flow to sectors with higher-than-average profit rates. As investment in these sectors grows, however, profit rates will decrease, as a result of which capital will flow elsewhere. Naturally, the subsequent changes in profit rates and capital flows will press the profit margins in different sectors towards the average. The competitive allocation of resources across sectors is an important reason for the significant improvement of productivity in China.

3.2 Structural changes and productivity

China's industrialization originated from the era of the planned economy. However, it was not until the 1980s that industrialization directed by market demand began in earnest. Because of different growth mechanisms, the economic structure formed under the planned economy is obviously different from that in the market economy. In the planned economy, it was often alienated from the structure of market demand. It is therefore inevitable that structural changes occurred after the reform. Economic structure refers mainly to the structures of production, employment, demand and foreign trade. Judging from changes in the three major industrial structures (including production and employment structures) and structural upgrades in various industries, transformations of the industrial structure have direct effects on the productivity level. Structural changes, in turn, are the result of demand pulling and technological progress. In the transitional period, structural changes provide a strong impetus to changes in the industrial structure.

3.2.1 Despite improvement since the reform, China's economy still suffers from structural defects.

(1) Impact on productivity of structural changes in the three industries

At the beginning of the reform, there were serious defects in China's industrial structure. Compared with other developing economies of a similar development level, China had a large primary industry, while its tertiary industry was on the low side (see table 2). This was obviously a result of China's policy in the planned economy of favoring the development of heavy industries.

After the reform, market mechanisms began to play a greater role in resource allocation. Since the 1980s, the proportion of manufacturing industry in the national economy has been on a downward trend, while that of the tertiary industry (mainly services) has been on the rise. Thanks to this change, which was most significant in the 1980s, the lag of the tertiary industry in China has been diminished compared with other developing countries. In the 1990s, however, the share of the secondary industry started to ascend rapidly, reversing its downward trend in the previous decade. Meanwhile, the growth of the tertiary industry began to slow down, enlarging its gap with the other sectors.

Table 2 Comparison of the structure of three industries in the GDPs of China and India (%)

	1980	1985	1990	1995	2000
China					
Primary industry	30.1	28.4	27.1	20.5	15.9
Secondary industry	48.5	43.1	41.6	48.8	50.9
Tertiary industry	21.4	28.5	31.3	30.7	33.2
India					
Primary industry	38.1	33.0	31.0	27.9	..
Secondary industry	25.9	28.1	29.0	30.1	..
Tertiary industry	36.0	38.8	40.0	42.1	..

The reason for these changes in China's industrial constitution was both structural and strategic.

Moderation of the lag of the tertiary industry in the 1980s could mainly be attributed to the introduction of the market mechanism. In the 1990s, the lag again widened because of the growing export-oriented economy and the government's policy stance favoring foreign capital. Thanks to a high concentration of foreign capital and export-processing enterprises, the manufacturing industry has overtaken the service industry in its rate of growth.(See Column 5: "Why does China's manufacturing sector grow so fast?"). Another reason for the lag of China's service industry is the sluggish urbanization process, an issue to be discussed later.

As the structure of the three industries evolved to a reasonable level in the 1980s, improvement in resource allocation had positive effects on the level of productivity. When the balance was lost again in the 1990s, however, the effects came to be negative. This seems a plausible explanation for the decreases observed in total factor productivity against the backdrop of significant technological progress in the late 1990s when large amounts of foreign capital flowed to China.

Box 5 Why does Chinese manufacturing industry grow so fast?

China's rapid economic growth in the last 20 years or more has depended mainly on the growth of its manufacturing industry. Notwithstanding fluctuations, the proportion of value-added generated by the manufacturing industry in China's GDP has remained above 40%. Moreover, it has created half of China's fiscal revenues, and employed close to half of the labor force in cities and excess labor in rural areas. It is noteworthy that since the 1990s, manufacturing industry has been growing faster than the service sector. For the purpose of accurately understanding China's economic state, it is helpful to thoroughly study this special character of its manufacturing industry.

First of all, China has a vast territory. Despite substantial progress in the developed areas of the east, the country's infrastructure is still in serious need of improvement. Since the 1990s, investment in infrastructure has been increasing rapidly. For example, investment in municipal public infrastructure projects has been on a constant rise. Total investment in the "Ninth Five-Year Plan" period (1996-2000) was 700 billion *yuan*, 2.7 times the level of the "Eighth Five-Year Plan" (1991-1995). Since the start of the 21st century, the increase of investment in municipal public utilities has accelerated. In 2001, national expenditure on constructing and maintaining public utility projects were 250 billion *yuan*, an increase of 34% over the year 2000. The huge demand for manufactured goods generated by the massive upgrades of infrastructure has spurred the growth of the manufacturing industry.

Secondly, China's comparative advantage is still to be found in its manufacturing industry, which has attracted the world's biggest manufacturers to the country. Because of its unsustainability, the advantage of the low labor cost is not the key determining factor. What is enjoyed by foreign investors who have set up production bases in China is a comprehensive cost advantage. This includes proximity to the world's largest consumer market, a well-functioning infrastructure (especially in eastern China), a complete industrial system, smooth information transmission, efficient logistics and, most of all, a deep reservoir of high-quality human capital. China enjoys substantial advantages in these aspects over other developing countries. Therefore, even if its labor cost is higher than in the surrounding countries, China is still the primary choice of investment location for many multinational corporations. Since the 1990s, China's exports have been increasing rapidly, from $62.1 billion in 1990 to $249.2 billion in 2000 and to over $500 billion in 2004. The manufacturing industry is the major exporter, accounting for over 80% of total exports in 2002. Most exported goods are manufactured by the 230,000 or so foreign-invested enterprises that are responsible for 54% of China's exports. In the two largest exporting industries, electro-mechanics and advanced technology, exports by foreign-invested enterprises account for 68% and 85% of the industry-wide volume respectively. These enterprises contribute 27% of the nation's industrial added value and 29% of the gross output value. Moreover, taxation on capital import accounts for 25% of total revenues from industrial and commercial taxes, the fastest growing of all tax items. Finally, foreign-funded enterprises provide employment for over 23 million Chinese people. They have become an important pillar of China's economy.

The sluggish growth of the service industry is a third reason why China's economic growth has been led by the manufacturing industry. This sluggish growth is attributable to lags in the urbanization process, slow growth in personal income, the large income gap, and the traditional Chinese values of hard work and thriftiness.

The comparative advantages of China's manufacturing industry are coming to be shared by the world. On one hand, the influx of foreign capital has supported the development of the manufacturing industry. On the other hand, it has brought enormous pressure on domestic firms. This will give incentives to Chinese enterprises to increase competitiveness. It is foreseeable that the Chinese economy will continue to depend on the manufacturing industry for impetus to growth for a long time to come.

The analysis above focuses on the structural changes across the three industries. We can also analyze the evolution within each industry.

(2) Structural upgrade and productivity of the industrial sector

Industrialization is not independent of the upgrading of the industrial structure. Generally speaking, the process of upgrading can be divided into three stages and six periods: the stage of formation of heavy industries (divided into two periods, one with raw material industries as the centerpiece and the other with processing and assembly industries); the stage of intensive processing (divided into two periods, one with general processing industries as the centerpiece and the other with technology-intensive processing); and, finally, the stage of technological concentration (divided into two periods, one with general technology-intensive industries as the centerpiece and the other with high technologies). There are overlaps between adjacent periods. Because of the pattern of foreign trade and the nation's development strategy, there are also overlaps among the three stages.
In a market economy, continual upgrades of the industrial structure are the result of changes in the demand structure and an optimal flow of resources. For a developing country, the process of industrialization is also the upgrading process for the industrial structure. Upgrades in the industrial structure will trigger changes in the entire technological level and the added value of products, thus improving productivity for the industrial sector. The industrial structure has a direct bearing on the comparative advantage and global competitiveness of a country.

Unlike its fast-growing economy, China's industrial structure has evolved slowly since the reform. As an example, the general processing industry is still a large component of the national economy, while the growth of technology-intensive processing has been slow. The sluggish process of technological concentration is attributable to a shift of the center of industrial structure towards light industries and to the low level of intensive processing. According to UNIDO's specification of light and heavy industries, the share of light manufacturing industries in China's production structure first declined and later rose in the 1980s, from 29.8% in 1980 to 27.9% in 1985, and then to 31.2% in 1990. During the period of correctional policies (1990-92), the share decreased by a relatively large margin, from 31.2% to 27.4%. After 1992 it increased continuously from 27.4% to 34.6% in 1998. In the meantime, the proportion of heavy manufacturing industries declined. Since 1993, the share of most general processing industries has either increased or remained constant, with rapid rises in electric and telecommunication equipment manufacturing and slow increases in the combined share of the six electromechanical industries, from 26.2% in 1992 to 26.7% in 1997.

As a result of these changes, low-level, low-quality products or products with low technological content and low value added dominate the market supply of industrial goods. There is a severe shortage of products of high quality, high technological content and high value added, even in industries with substantial excess supplies. Consequently, the supply structure of industrial products cannot meet the needs of urban consumers wishing to modernize their consumption pattern or producers wishing to upgrade their technological level. Nor can it strengthen China's global competitiveness or expand its exports. Undoubtedly, the slow upgrading of the industrial structure has adverse effects on improving China's productivity level.

Technology, economic structure and production scale were all reasons for the slow evolution of China's industrial structure in the late 1980s and the 1990s. Technology-wise, it was the sluggish development of the equipment industry. For want of high-technology-level domestic supply, Chinese industrial enterprises had to rely on imported equipment to bring about

technological transformation. The forbiddingly high price of imported equipment, however, limited the extent of technological transformation and technological progress. Another victim was the technology-intensive industry. Structure-wise, non-state-owned enterprises were underdeveloped, while their state-owned counterparts enjoyed a monopoly in most markets, lowering the degree of effective competition. The regulating function of the market was not given full play. In addition, the rapid industrial growth in this period (at 17.0% annually from 1989 to 2001) relied too much on investment, which had led the development of the processing industry away from the trend to intensive processing. Scale-wise, most enterprises were too small in size. In the 1980s, the proportion of collectively and individually owned enterprises increased rapidly, an adverse trend for the development of scale economies.

3.2.2 Increases in non-agricultural employment have considerably enhanced productivity since the reform

In the pre-reform system of collectivized agricultural production, peasants in China had no right to independent production or management. State monopoly of purchasing and marketing severed their connection with the market. With a lack of price incentives, the efficiency of agricultural production was very low. In addition, farmers could only earn a small income from the meager added value of processing and circulating agricultural products. In 1978, before the reform, about 250 million people in rural China lived in poverty.

China's reform began from the countryside. Agricultural reform, starting from the family responsibility system in the late 1970s, revolutionized the rigid system of the rural economy. Regaining management responsibility for land, farmers became independent entrepreneurs bearing sole responsibility for losses and profits. Rural reform liberated labor from the land, preparing the way for the development of rural and other non-agricultural industries. The emergence of township enterprises in the 1980s played a positive role in transforming the socio-economic structure and absorbing surplus labor in rural China.

At their onset, township enterprises were mainly localized industrial producers, "leaving the soil without leaving the town." Later, rural workers migrated in masses across regional borders to find employment in developed areas. Data of the fourth and the fifth censuses indicate that the scope of population shift expanded rapidly. Nationwide migration climbed from 11.102 million people in 1990 to 42.419 million in 2000, an increase of 382%. The destinations of migrating labor were mainly Shanghai, Beijing and Guangdong. Up till now, hundreds and millions of peasants have moved from the agricultural sector to the industrial and other non-agricultural sectors, providing an enormous impetus to China's economic growth. Studies have shown that the migration of rural labor to the industrial sector has increased the average contribution of labor allocation to GDP growth to 1.5 percentage points. This does not yet include its contribution to the returns to adjustments in the industrial structure (World Bank, 2000). As such a large number of peasants have moved from the agricultural sector with low productivity to the non-agricultural sectors with higher productivity, the subsequent increases in overall productivity are not at all surprising.

This massive migration of rural labor to non-agricultural sectors has accentuated China's cost advantage. The development of township enterprises where labor "leaves the soil without leaving the town" is an example of the policy of lowering the cost of rural industrialization. Currently, there are 480 million rural laborers in China, of whom 160 million are employed by township enterprises and other non-agricultural industries while the remaining 320 million

work in agriculture. Calculations show that 150 million are needed for planting and cultivation, 20 million for foresting, fishing and cattle breeding, which makes a total demand of 170 million in agriculture. There is, therefore, a surplus of 150 million, to which over 6 million new workers are added every year. Peasant workers need neither housing nor all the non-salary benefits, such as social security, demanded by urban residents, since all these can be satisfied locally. Moreover, requisitioning the land owned by villages and towns is virtually cost-free. Rural industrialization based on excess labor and cheap land thus involves little economic cost. This cost advantage has been carried over to the flow of rural labor to developed areas. It has shifted the center of global processing and purchasing to China, gradually turning China into the world's largest workshop.

The industrial development accompanying increases in non-agricultural employment is in fact merely a transitional stage of China's industrialization and urbanization process. In the 1980s, taking advantage of the final phase of the era of economic shortages, and before the reform of state-owned enterprises had started in earnest, township enterprises took the lead in structural changes. As the former were reinvigorated with the reform, however, the advantages enjoyed by the township enterprises weakened, while they, as collectively owned entities, continued to share many of the troubles of state-owned enterprises. After 1997, economic returns and the growth rate of collective enterprises in villages and towns both declined substantially. The model of scattered development for township enterprises has completed its historical mission with the end of China's shortage economy. What awaits them in the future is either elimination in competition or transformation into modern firms by relocation to the city in the urbanization process. The non-agricultural employment created by township enterprises has, therefore, only had a short-term effect on the rise of productivity since the reform started.

At present, the vast majority of rural laborers moving to developed areas find only temporary employment, and are unable to settle down and become official residents of the city. Without permanent residence, they are denied all the social welfare and security benefits enjoyed by their urban compatriots. For this reason, what they represent is merely flows of labor rather than migration of population. How to turn the rural labor flowing to urban areas into a migrated population is a big practical problem that China must solve if it is to transcend its dual economic structure and realize the coordinated development of urban and rural areas. It is also a problem in urgent need of further investigation.

Relative to its population, China does not have abundant land resources. As its use did not involve direct monetary outlay, land was excluded from business accounting and was considered "valueless" in the planned economy. Over 25 years since the reform started, China still resists the development of a market for land in rural areas where free trade is allowed. The requisition of land is therefore virtually cost-free. Low-priced leases are among the many sweet deals that China has offered to overseas investors to attract foreign capital.

This industrialization process in China has been characterized as relying on farmers and foreigners, and realized at the costs of social welfare and recourses available to peasants. As these costs are not reflected in the accounts of China's economy, the increases in productivity thus calculated must be unsustainable.

3.3 Urbanization and productivity

Urbanization is a natural consequence of industrialization. Two transfers will emerge with the development of urbanization: first, the transfer of labor from areas with lower productivity to those with higher productivity, represented by the migration of peasants to the city and, second, the transfer of labor from agriculture to other sectors. In both forms of transfer, labor flows in the direction of higher productivity. Urbanization will, therefore, provide strong impetus not only to economic growth, but also to China's productivity increases.

A country's urbanization should progress in step with its industrialization process. China's urbanization process has been accelerating since the reform started. So far, over 100 million peasants, or 20% of the total rural population, have found employment in the cities. The number permanently settled down in an urban area has also been continuously increasing. In 2000, urban residents accounted for 30.9% of China's population, a substantial increase from 18.2% in 1978. Nevertheless, according to most scholars, China's urbanization is slower than its industrialization process. An international comparison reveals that its degree of urbanization is not only considerably smaller than the level of 75% in developed countries, but also below the average of 37% in developing countries. In many a developing economy, urbanization has developed abreast of industrialization and economic growth. In China, however, its urban population has grown at an annual rate of 3% over the past half century, just 1.2 percentage points higher than the growth rate of its total population. It is also much lower than the rate of 8% of its industrial growth.

Hindering the increase in China's productivity level, this lag in urbanization has created a series of conflicts for the sustainable, rapid and sound development of the economy. The demand deficiency that China is suffering from can be attributed, to a large extent, to a lack of demand stimulus in rural areas. Insufficient consumption in the country can in turn be traced to constraints imposed by the urban-rural dual economic structure and by the lag of urbanization of the rural population. The sluggish progress of China's urbanization process is also an important reason for the small share of tertiary industries in the national economy. Moreover, township enterprises have come to bear the pressure of restructuring and upgrading their industrial level. They have a large demand for capital and technologies, and an urgent need to develop economies of scale. Further development thus calls for township enterprises to move rapidly from the country to the city. In addition, the industrialization process dispersed in rural areas, characterized by diseconomies of scale and imbalanced regional allocation, damages natural resources, causes environmental pollution and wastes land that could be better used for cultivation.

The experience of other countries shows that labor flows and the settling down following migration usually take place simultaneously. However, because of structural factors like the household registration system, rural labor in China must reach the goal of settling down in the city in two stages. First, it must leave the country and find suitable employment in an urban area, which is referred to above as non-agricultural employment. Second, migrated laborers or successful members of the wave of non-agriculturally employed seek to settle down in their adopted city after they have started a career. Whether the flow of labor can be turned into a permanent migration of residents from rural to urban areas, and whether fundamental changes can take place in the social status of migrated workers, have come to be practical problems with an important bearing on China's ability to transcend its dual socio-economic structure and to realize a coordinated development of its urban and rural regions. Compared

with the first stage, the second stage of labor movement is subject to more influences, including structural and policy constraints and the character of the peasant workers.

The existing reforms have made possible the completion of the first stage of labor movement. There are, however, considerable obstacles in the second stage, owing to reforms that have not yet started or accomplished. This has also harmed the urbanization process and the demand for consumption goods. China's urbanization process, therefore, hinges crucially on completing the second stage of labor movement and identity change, without which the real urbanization process cannot be finally accomplished.

For this reason, China needs structural changes. First, reforms of the household registration system must be accelerated to lower the threshold of entry to the city. Second, a social security system satisfying the needs of peasant-workers must be established to protect them from poverty caused by unforeseeable risks. In addition, sufficient education should be offered to rural laborers to help them adjust to the urban environment by improving their qualifications and employment skills. A large number of rural laborers are having trouble finding permanent employment in the city because of poor qualifications and lack of skills. Among them, 38.2% have had primary school education or less, 49.3% have completed junior high school, 11.9% are graduates of high school or professional schools, 0.6% have received higher education and 9.1% have obtained some professional training. With economic development and the rise of new industries, society has increasing demands of the workforce's qualifications. It will be more and more difficult to transfer rural labor to areas in which it does not have the necessary skills. Teaching new skills to the peasant-workers will be an urgent but formidable task.

To turn peasants into urbanites requires large amounts of investment, whether in expanding the scale of infrastructure, establishing a social security system, or providing professional training. Other countries' experience shows that expenditure on the social security system is the largest investment in the urbanization process. Undoubtedly, the completion of this process will help improve productivity by facilitating the accumulation of human capital and stimulating the demand for consumption. Nevertheless, it will also increase of the cost of industrialization for China.

3.4 Growth pattern and productivity

Estimation of the growth of TFP is based on calculating the difference between the growth in production and that in total factor input. Both the nature of input and output and their dynamics create changes in TFP.

3.4.1 High investment rate and productivity

China has had a high savings rate, especially since the reform started. High savings have maintained a high level of investment (see Appendix Table 5). Nonetheless, the technological contents of investment before and after the reform are different. On the one hand, this difference is associated with an increase in the absolute level of technology, while, on the other, it is attributable to the post-reform importation of advanced technologies on a relatively high level. Capital stock is the accumulated sum of capital goods over several periods. A high

rate of investment directly helps keep the capital stock up to date. In other words, it increases productivity by introducing new and advanced technologies.

As a developing country, China has seen rapid changes in its industrial structure, especially the structure of products. Together with the influx of foreign capital, this has shortened the economic life of many capital goods, providing another reason for the relatively young age of China's capital stock.

In terms of the calculation of productivity, this may cause the actual rate of depreciation to be higher than the accounting or the nominal rate, overestimating capital input because of insufficient depreciation, while underestimating TFPG. As a side note, capital goods in different periods are measured by the market value of the investment cost. Therefore, the value of capital goods of different periods must be converted with a constant price before summation. Today, in this time of rapid changes in the quality, technological level and variety of products, it is a formidable challenge to select the appropriate price index for capital goods. Since price changes are often concurrent with rises in product quality and efficiency, it is difficult to tell whether a price increase is attributable to better quality or improved efficiency. Generally speaking, the official price index does not take full account of disproportional increases in the quality of products and services. Because of significant imbalances in the economic growth of a developing country, domestic price indices usually fail to fully account for increases in the quality and efficiency of imported equipment, thus giving rise to insufficient depreciation of capital goods and underestimation of TFPG.

However, economic growth characterized by excessive investment and insufficient demand for consumption goods is not sustainable. In such cases, the marginal returns to capital will decrease until eventually productivity growth slows down or becomes negative (See pp. 6-8, "Excessive penetration of capital and the decline of TFP").

3.4.2 Economic fluctuations and productivity

Because of market failure and government failure, economic fluctuations are inevitable. Research shows that changes in TFP are closely associated with economic fluctuations. The reason is that estimation of the growth of TFP is based on calculating the difference between the growth of production and that of total factor input. Since the growth of factor input is relatively steady, economic fluctuations are the immediate source of variations in total factor productivity. When a TFP increase is broken down into technological progress and changes in technological efficiency, TFP is shown to be more closely associated with the latter. An index of the degree of production capacity, technological efficiency is in turn strongly correlated with economic fluctuations. In comparison, technological progress, or shifts of the production possibility frontier, must be steady. As the economy reaches a peak, production approaches full capacity and TFP is relatively high. On the other hand, when the economy is in a trough, production capacity is not fully employed and TFP is subsequently low.

Economic fluctuations have significant adverse effects on productivity. Wild oscillations in the economy directly hamper the full employment of production capacity and efficient resource allocation, giving rise to enormous wastes of resources and production factors. A chief task of macroeconomic policies is to avoid such violent oscillations. Before the reform started, China's economic growth was highly unstable. The fluctuations could be described as

having large magnitude, high peaks, deep valleys, low averages and short lengths of expansion. Since the reform started, variations in the economy have become much milder. Relative to the pre-reform period, the magnitude of fluctuations has been lessened, the distance between peaks and valleys narrowed, the average raised and the length of expansion extended, turning from wild oscillations before the reform into gentle growths at a high level (see Appendix Table 4). This change in the pattern of growth has favorable implications for the improvement of productivity.

The evolution in the pattern of growth is mainly attributable to enormous changes in the inherent mechanism and external environment of economic fluctuations that have taken place since the reform started. Before the reform, the main restraint on the upper limit of economic expansion was a lack of resources, such as financing, energy, raw materials and means of transportation. This has changed to inflation since the reform started. The pre- and post-reform restraints on the lower bound, on the other hand, are a need for survival and employment respectively. The major cause of economic fluctuations in China has gradually changed from resources to market demand. The external shock to the economic stability of China is manifested by the change in the form of macroeconomic policies from administrative decrees to economic incentives.

In addition, the political environment has had a great influence on economic fluctuations, both before and after the reform. In China, political stability is an important prerequisite to economic stability. In this great historical moment of transition between the old and the new socio-economic systems, serious precautions should be taken against the many potential elements of instability that lurk in China's immature socio-economic structure, including violent oscillations in the economy.

3.5 Education and productivity

According to classic economic theory, education is an important determinant of productivity because of its direct effect on the quality of labor input. In modern growth theory, human capital has been identified separately as an important source of economic growth. As a main approach to forming human capital, education has always been treated as an important instrument for identifying or measuring human capital. A lot of empirical research has proved its positive effect on productivity and its remarkable contribution to economic growth. The experience of China is no exception.

3.5.1 Rapid development of education in China

The Chinese ethic attaches great importance to education. Since the foundation of the People's Republic of China, education has developed rapidly. As Figure 3 shows, from 1964 to 2000, the numbers of people with varying educational attainments per 100,000 persons have all increased. In particular, those with junior college degrees and above have risen more than 7.68 times, from 416 to 3,611; those with high school or professional school degrees more than 7.45 times, from 1,319 to 11,146; those with junior high school more than 6.25 times. However the growth of the primary school category has been very small.

Higher education is an important aspect of China's educational development. From 1964 to

1982, the nation's cultural and educational progress was severely hampered by the Cultural Revolution. During that period, most colleges and universities were not permitted to recruit students, shutting the door to higher education to a large number of potential high school and professional school graduates. As a result, China's stock of college graduates grew slowly, by an average of 71,967 persons per year.

Since the recruiting system was restored in 1977, the share of the Chinese population that has received higher education has expanded rapidly. From 1982 to 1990, the number of people with junior college degrees and above per 100,000 persons rose from 615 to 1,422, an annual rate of 9.76%. The average total increase was 1,118,295 every year. The years between 1982 and 1990 saw 15.54 times as many college graduates as between 1964 and 1982.

China's higher education continued to grow rapidly in the 1990s. In this period, the burden of financing shifted from the government to the recipients of education, who had to pay tuition and other fees out of their own pocket. Various types of informal education, such as adult schools and self-study programs, also began to flourish.

The number of people with junior college degrees and above per 100,000 persons rose from 1,422 in 1990 to 3,611 in 2000, with an annual rate of 8.84%. The total increase was 2,418,260 per year on average. The decade saw 2.16 times as many college graduates as the years between 1982 and 1990.

Intermediate education developed along a path slightly different from that of higher education. The number of graduates from high schools/professional schools and junior high schools grew rapidly even during the "Culture Revolution", with the former increasing at a higher rate than the latter. The reason was that, while there were scant resources for higher education, the government did provide relatively extensive opportunities for junior high school graduates to advance to the next educational level.

After the reform started, growth in the number of people with junior college degrees and above accelerated, while changes in the categories of secondary education were comparatively stable.

Finally, the steady development of primary education has played a decisive role in reducing the rate of illiteracy in China. From 1964 to 2000, the numbers of illiterate decreased from 233.27 million to 85.07 million, the illiteracy rate declining from 33.58% to 6.72%.

Table 3 Selected statistics from the national censes in 1964, 1982, 1990 and 2000.

	1964	1982	1990	2000
Total Population (10, 000 persons)	59,435.00	69,458.00	100,818.00	113,368.00
Junior College Degrees and Above Per 100,000 Persons	416.00	615.00	1,422.00	3,611.00
Total with Junior College and Above (10,000 Persons)	..	..	..	4,093.70
High school and Professional School Degrees Per 100,000 Persons	1,319.00	6,779.00	8,039.00	11,146.00
Total with High school and Professional School Degrees(10,000 Persons)	..	..	..	12,636.00
Junior High School Degree Per 100,000 Persons	4,680.00	17,892.00	23,344.00	33,961.00
Total with Junior High school Degree (10,000 Persons)	..	..	..	38,500.90
Primary Schooling Per 100,000 Persons	28,330.00	35,237.00	37,057.00	35,701.00
Total with Primary Schooling (10,000 Persons)	..	..	..	40,473.50
Illiterate (10,000 persons)	23,327.00	22,996.00	18,003.00	8,507.00
Illiteracy Rate(%)	33.58	22.81	15.88	6.72

Data source: China Population Year Book, 2003

Continuously increasing investment was the primary impetus for the development of education in China. From 1991 to 1999, educational outlays climbed more than 3 times from 73.15 billion *yuan* to 384.91 *yuan* (Shen et al, 1998 p. 116). Research shows that, if educational expenditure is defined as human capital, the general educational level of the Chinese has improved. Moreover, the average outlays within each category of educational level have also increased to different degrees. This is evidence that the quality of education has improved. A better educated labor force and improved educational quality have both significantly benefited the accumulation of human capital. The research by Shen et al (1998) shows that from 1965 to 1995, the stock of human capital increased rapidly in all economic sectors, with the annual rate of growth being highest in commerce and construction (15.4%), and lowest in heavy industry (9.8%).

3.5.2 Correlation between educational development and the improvement of productivity

Shen et al (1998, p.119~120) show that the acceleration of the accumulation of human capital in every economic sector made substantial contributions to the increases in the amount of value added in China. In some sectors, such as commerce, transportation and telecommunication, human capital could explain over half of the increase. It has even become

the most important source for growth in commerce and other sectors of non-physical production.

Combining Table 1 and the data supplied by UNIDO reveals that there is a strong correlation between increases in labor productivity and educational development in China. From 1966 to 1978, when education, especially higher education, was in a paralysis, labor productivity increased slowly at an annual rate of 1.1%. After the reform started, the development of education embarked on a trend of fast growth. From 1982 to 2000, the illiteracy rate plummeted while the share of population that received higher education increased rapidly. At the same time, labor productivity rose at an annual rate of 6%. Education in China underwent the fastest growth from the early days of the reform to the mid 1990s, increasing at a rate of 9.76% per year (1979~1994). In about the same period (1979-1994), growth in labor productivity also reached the highest level with a rate of 6.1% per year.

The high correlation between educational development and changes in labor productivity implies that education has not only promoted economic growth but also made great contributions to increasing labor productivity. With its importance endorsed by the new growth strategy of "development through science and education," education will play a larger role in enhancing productivity and reforming the erstwhile development model of extensional growth.

3.5.3 Challenges to the development of education in China

Notwithstanding the remarkable achievements made so far, there are still many problems in China's educational system, the most significant being the small proportion of the population with advanced education and the large proportion with less than intermediate level schooling. According to "*The Report on Problems of Education and Human Capital in China*" published by the Ministry of Education in 2003, a large share of the population in developed and newly industrialized countries has intermediate or higher education. For instance, 87% and 66% of those aged between 25 and 64 have had at least high school education in the US and Korea respectively, while the ratios of those with more than college education are 35% and 23% respectively. In comparison, only 18% of the same population group in China have received advanced education, 8.2% have received less than junior high schooling, and 42% have received less than primary education. The number of people with college degrees or above is no more than 5 in every 100.

The development of higher education in China did not gather momentum until 1998 when the Ministry of Education decreed an enlargement of the scope of college recruitment. The short period of time since then has yet to provide sufficient opportunities for advanced education for most Chinese. Because of a deficient overall capacity in the educational sector, the share of people with at least a high school education is very small. According to the 5th National Census in 2000, only 12.7% of the employed had received high school or professional school education, while the majority (about 75%) had had less than junior high schooling.

Various problems emerge in comparing statistics from the 5th Census of China with the relevant data for Japan. In 2000, the average period of schooling for workers in the first industry was 6.79 years in China and 10.67 in Japan. From 1997 to 1999, the productivity of labor in China's agricultural sector was barely 1.03% of the level of Japan. Workers in China's second industry, consisting mainly of manufacturing and construction, had on

average 9.44 years of schooling (equivalent to junior high school), 3 years less than their counterparts in Japan. Among these workers, the share that had received at least college education in China was only 1/5 of Japan's level. Undoubtedly, increases in the overall qualifications of workers are a prerequisite for continuous technological progress and improvements in labor productivity in China's manufacturing industry. Finally, in the tertiary industries such as finance and insurance, where the demands for education are high, the average period of schooling was 13.19 years, 0.8 year less than in Japan.

Information from the labor market shows that there is a severe shortage of high-level professionals and technicians, directly hindering an increase in productivity. As multinational companies swarm to China, the shortage of high-level managers is becoming increasingly acute. Meanwhile, many Chinese firms are well armed with capital, projects and capacity for R&D, but short of skilled and capable employees. A survey conducted in Shenzhen in 2005 reveals that a severe lack of skilled labor has impeded the improvement of product quality, and the absorption and application of mature technologies. Among the enterprises sampled, 68% said it was difficult to recruit high-level technicians who could solve practical problems in production and improve labor productivity. In Shenzhen, the current demand for skilled labor is 105,000, but the number of applicants with technical certification is only 53,000, 52,000 short of the demand. In particular, the shortage of high-level technicians is over 30,000.

The sluggish growth of human capital is even more acute in rural areas, because of the lack of financing and an imbalanced allocation of educational opportunities. In terms of the ratio of educational expenditure to total GDP, China's investment in rural education is well below the world average. In particular, county and village governments are in a deep financial crisis owing to the imbalance between their fiscal income and their responsibilities. The development of education in rural areas is severely hampered by the lack of investment. Defaults in paying teachers' wages occur frequently and the basic conditions for running a school cannot be satisfied. This lack of investment has also undermined the basis for reforming the financing system for education in rural China. Due to widening gaps in investment across regions, educational resources are unequally distributed, with the regional disparities mainly manifested by the inequality of educational level between urban and rural areas. In 2000, the average period of schooling for people aged above 15 was 6.85 years in rural areas, 3 years less than in the city. Although there has been a large decrease in the illiteracy rate among adults (8.72% in 2003), there are still 85.07 million illiterate people in China, of whom 20 million are aged between 15 and 50, and with over three quarters of illiterate adults living in rural areas in the west, regions of ethnic minorities and counties under the national poverty level.

In conclusion, China must make long-term efforts in educational development, especially in increasing investment in rural areas. Moreover, the market calls for a variety of professional training aimed at promoting labor productivity and technological progress. The economic growth thus created will help enhance China's ability to survive and develop in the long run.

4. Social development

The economic reform and the subsequent political transitions have created fundamental changes in Chinese society. China has evolved from a closed, rigid country into an open, dynamic society. The introduction of a market mechanism has liberated the pursuit of

materialistic interests to an unprecedented degree. China's experience of economic development has fully demonstrated the strength and efficiency of the market. The strength of the market lies in its ability to facilitate the pursuit of personal interests. However, reliance on economic incentives alone is not sufficient for the creation of a socio-economic structure that answers the needs for social justice, ecological laws and sustainable development. It is now an acute problem in China that social development lags behind economic growth. A potential source of social instability, this imbalance has adversely affected economic growth and the improvement of productivity.

4.1 Dual economic structure and the widening income gap

Before the reform, China's major issue was general poverty under an equal income distribution. Disparity between the rich and the poor was mainly displayed between urban and rural areas. In 1978, per capital GDP was 1290 *yuan*. About 250 million people lived in poverty in rural China, a poverty rate of 30.7%. Twenty-five years after the reform started, in 2003, per capita GDP exceeded $1,000. The number of rural residents living in poverty declined to 29 million, reducing the poverty rate to 3%. This is nothing short of a miracle. Nevertheless, one should not ignore the income gap that has widened rapidly across regions and population groups.

The income gap between urban and rural areas diminished gradually between 1978 and 1985, but has broadened again since 1985. In the first period, the family responsibility system implemented in China's countryside facilitated the decrease in urban-rural disparity, reducing the income ratio from 2.57:1 in 1978 to 1.86:1 in 1985. But the trend was reversed in 1984, when structural reforms were launched in the city. The urban-rural income ratio increased to 2.79:1 in 2000 and then 2.92:1 in 2001. If the invisible incomes of urban residents, such as subsidies, welfare payments and earnings from a second job are taken into account, the actual gap is even wider, as high as 5:1 to 6:1 by some estimates. In 1995, the International Labour Organization issued a report on the income ratio between urban and rural residents in 36 countries. According to the report, the average ratio was 1.5:1, with only three countries, including China, exceeding the level of 2:1. The urban-rural disparity in China is even more severe than in those developing countries recognized for highly unequal income distribution. Moreover, the disparity is expected to expand farther for a long time into the future.

In 1997, the World Bank released a report entitled "China 2020: Development Challenges in the New Century", in which it pointed out that the Gini coefficient of China was 0.28 in the early 1980s, increasing to 0.38 by 1995. According to the report, this proved that China was only slightly better than the Sahara African countries and Latin America in income disparity. There is no other country in which the income gap changed as dramatically in merely 15 years. In a separate study, the Institute of Economics at the Chinese Academy of Social Sciences issued a survey of income distribution in which they reported that China's Gini coefficient was 0.454, that of the city 0.319 and that of the countryside 0.366 in 2002. Given the mild income disparity within urban and rural areas, it is evident that the post-reform gap between the rich and the poor concerns mostly the inequality between urban and rural regions. This is clearly a result of China's dual economic structure.

Since the reform started, the relative regional disparity of per capita GDP in China has gone through two stages. The first lasted from 1978 to 1990. In the first half of the 1980s, there was a trend of significant decrease and convergence of relative disparities among provinces

and regions. The decline slowed down in the latter half of the decade. The second stage spanned the entire 1990s, when income disparity as well the development gap widened again across regions. The ratio of per capita GDP between Shanghai and Guizhou, the poorest province of China, was 7.3:1 in 1990, increasing to 12.1:1 by 1998. Likewise, the ratio between Guangdong and Guizhou rose from 3:1 in 1990 to 4.8:1 in 1998.

The enlarging disparity across regions and the urban-rural divide is in part attributable to the concentration of production factors in areas of high economic return. A natural result of the optimization of resource allocation in a market economy, this has a positive effect on the increase of productivity in China. Nonetheless, there are also subjective causes of the wide disparity in income: strategic and structural errors in economic development.

For a long time, the government followed the strategy of using agriculture to amass the capital necessary for industrialization. Too much was asked of the millions of peasants, undermining their capacity for independent development. Although this strategy was justifiable in the initial stage of industrialization, it is inequitable, unreasonable and incongruous, when the process has reached an intermediate level, to continue upholding the dual structure in which the segmentation between urban and rural areas is maintained or even strengthened in the interest of the city. This is particularly so for the peasant-workers who have left their land for low- to medium-level employment in the city. Deprived of the right to participate in political actions and to advocate their interests, they are subject to the most severe discrimination. Moreover, the lack of unemployment insurance or social security may force some of them to take extreme measures when their subsistence is endangered, posing a potential threat of instability to society. If not absorbed by an appropriate social security system, the peasant-workers will remain nomads in the city. The social problems thus created will have an adverse impact on the safety and efficiency of China's socio-economic development.

To address the problem of regional disparity, the central government launched the strategy of "development for the west" in 2000. Investment in the western inlands has been increased considerably, totaling 850 billion *yuan* over a period of five years. Notwithstanding its positive role in slowing down the expansion of income disparity between the east and the west, the return on such massive investment is questionable.

4.2 Negative impact of widening income gap on economic growth and productivity increase

The income gap across regions, population groups and the urban-rural divide is a manifestation of China's dual economic structure. At a certain stage of economic development, a widening disparity is inevitable; indeed, an appropriate amount of inequality is beneficial to economic growth. However, excessive disparity has a negative effect.

The dual economic structure has generated enormous geographic in China's development. On the one hand, there is a great deal of prosperity in the city, where China's population of 1.3 billion forms a gigantic potential market. On the other hand, farmers make up the majority of the population. Meager increases in income have significantly lowered their demand for consumption goods, which is the direct cause of insufficient demand at the national level. Insufficient demand for consumption goods resulting from backward development in rural

areas has been a significant restraint on economic growth and the development of economies of scale in China.

The substantial urban-rural disparity in development, income and consumption is both a restraint on economic growth and a source of potential development in the long run. For China, it is an opportunity as well as a challenge.

4.3 Sluggish development of the public sector

In the planned economy, the state assumed market functions that should have been taken on by private institutions. Since the birth of the market economy, great changes have taken place in the institutional framework and operating mechanism of Chinese society, including those of the public sector. In the face of insufficient investment and low efficiency in the public sector, the government has undertaken massive structural reforms, leading directly to continuous reductions in public services. Development of the public sector in China lags considerably behind the country's economic growth. These problems are the result of both market failure and government failure, both insufficient marketization and excessive marketization.

With continuous development in the market system, in the economy, in people's living standards and in social modernization, the role of the government has come to be that of provider of public goods and services. In this functional transition, challenges arise for the government to redefine the scope of public provision, to determine the means of supply, to promote efficiency in the public sector and to better satisfy the needs of the public.

(1) Social security

The social security system is an important means of preserving a normal standard of living and alleviating income disparity. Moreover, a well-functioning social security system can increase the mobility of labor, facilitating its flow from old, low-productivity firms to efficient enterprises, and promoting technological progress and resource allocation.

A robust safety net will also stimulate savings and economic growth. The management system of investment funds will influence the rate of capital creation and its allocation. Whether a fund can be invested in sectors with high productivity determines the level of total factor productivity and the rate of capital accumulation.

Rapid development of the economy has set in relief a series of problems in the social security system. First, market-oriented reforms have gradually transfigured the provision of social security from a fiscal responsibility of the state to a highly decentralized market behavior, threatening the livelihood of those stricken by unemployment or poverty. As state-owned enterprises focus increasingly on capital, the number of workers laid off will continue to increase. Second, a poorly developed social security system in rural areas has failed to provide adequate protection for China's rural population. At present, provision of social security in the countryside relies mostly on government funds, without which earnings from the land would be the only source of financial support for the farmers, especially for their retirement. IThird, as China's population ages, the ranks of retired or about-to-retire Chinese will swell, demanding huge amounts of social security funds to maintain their livelihood and

health. Under the old pay-as-you-go system, China has accumulated a deficit of 2.5 trillion *yuan*, almost equal to the national income of one year. It is an urgent task for the government to eliminate this deficit.

(2) Public health

The national health level has a direct impact on the efficiency of a country. For a long time, China was close to developed countries in terms of life expectancy, despite its poor economy and low income level. This was thanks to a well-functioning public health system in its planned economy.

After the reform started, economic growth replaced public health as the main focus of the government's attention. In 2000, China spent 5% of its GDP on health services, slightly higher than the lowest limit stipulated by the World Health Organization. Nevertheless, the share of out-of-pocket expenses borned by patients was 60.6%, much higher than the rate of 27% in developed countries and even than that of most developing economies, including some of the least developed ones.

Despite significant improvements in medical conditions in the last few years, the state of public health has stagnated, or even deteriorated in certain cases. For example, after having been wiped out years ago, snail fever and various kinds of venereal diseases, such as gonorrhea and syphilis, have resurged, wreaking havoc in the affected areas. Moreover, the number of people infected by AIDS has been increasing at the rate of 30% per year. These problems can be traced to insufficient government expenditure on public health, an unjust distribution of medical costs, and over-zealous market reforms in the health sector.

Because of China's dual economic structure, fiscal outlays, especially expenditure on public services, are spent mainly on urban residents. As a result, medical resources are concentrated in medium- to large-scale hospitals in big cities. In addition, it is the local rather than the central government that is responsible for health expenditure. There is not an effective system for transferring payments across regions to balance the level of public services, including that of health care.

Government inefficiency and market failure have led to a soaring cost of medical care, whose growth rate far exceeds the rise of income in both urban and rural areas. Market-based reforms targeting the medical system have made health care prohibitively expensive for a large segment of the population. They have also lured the health sector to favor treatment over preventive care. China's experience proves that a purely private medical system without government regulation is incapable of supplying high-quality health services. It is thus an important issue for the Chinese government to regulate and strengthen the public health sector.

5. Restraints from resource endowment and environment

China faces enormous pressure from its population, environment and resource endowment. If the inability to sustain development is yet a remote issue for other countries, it is a realistic problem for China. China's population burden is the heaviest in the world. Because of this, China's per capita resource endowment is well below the average world level. Having

suffered excessive exploitation for years, China's ecological environment is extremely fragile. A high population density, coupled with fast economic growth, will further tax the ecological system beyond its capacity.

Population growth in China has been curbed thanks to the birth control policy adopted in the late 1970s. It is estimated that China's GDP has increased by 8.4 times since 1978, while its population has grown by only 35%, raising per capita GDP by 600%. These figures provide strong evidence of the success of the birth control policy. Over the last 26 years, the number of new births has been reduced by over 300 billion, saving 7,000 trillion *yuan* in childbearing expenses. The effective control of population growth and the continual increase in the quality of human resources have substantially improved the level of comprehensive national power, productivity and the standard of living. They have also relieved the pressure of population on resources, the environment and socio-economic development. Finally, they have partly resolved the conflict between a huge population and limited land, alleviating the shortage of food and some other resources. On the negative side, the birth control policy has given rise to a series of social problems in the aging of society and the large numbers of families with only one child.

The fast and extensional growth of the economy has placed in relief the problems of energy, resources and environment. China's recent high growth is partly the result of over-exploiting natural resources and the environment. By enjoying access to natural resources located throughout the world, developed countries were able, in their industrialization process, to extract resources from developing economies while exporting pollution to these countries. However, the developing countries currently undergoing industrialization are neither able nor allowed to help themselves to the global reservoir of natural resources. In China, the lifestyle and consumption level of developed countries is being imitated, without support, however, from an equally advanced technological and efficiency level. China's high growth can, therefore, only be realized at the cost of large quantities of energy and resources. It is thus a type of extensional growth characterized by high energy consumption and low quality.

In recent years, China's ecological system is being gradually restored, thanks to the strategy of sustainable development. However, the overall trend of deterioration has not been halted. Moreover, there are significant regional disparities in development. With the advance of industrialization, China is entering the stage in which the proportion of industrial pollution is declining, while that of residential pollution, including sewage, garbage, automobile emissions, and chemical fertilizers and pesticides, is rising rapidly. The sources of pollution are becoming more widespread than before. One of the largest water polluters in the world, China is seeing further deterioration in the quality of its water. Severe damage has been done to the sources of drinking water for urban areas. Despite modest decreases, the degree of air pollution in the cities is still unstable. Pollution caused by solid wastes is being aggravated by rapid increases in the volume of garbage created in the city. There has been a continuous decay of the land and the emergence of a significant imbalance in the ecological system of water. Man-made vegetation is far from enough to offset the ecological catastrophes caused by the destruction of natural vegetation. The momentum of devastation of biological diversity has not yet been arrested. On top of all this, China must also face global environmental problems. As a cost of economic growth, some of the above pollution and ecological damage is inevitable, while some is the result of neglect and excessive exploitation of natural resources.

Because of externality, the factor of ecological and environmental resources is not included in the accounting system. The GDP output and input of factors involved in the calculation of total factor productivity do not make allowance for the adverse impact of environmental damage on the economy. An investigation of GDP from the standpoint of sustainable development reveals that insufficient consideration has been given to the negative externalities created by economic growth, such as ecological damage, environmental pollution and pollution by disposables. The measured GDP includes considerable output value associated with superfluous, suboptimal or even harmful ways of living. Furthermore, the low pricing of natural resources has led to their underestimation in the measuring of GDP. Rapid economic growth and increases in total factor productivity are, to a great extent, obtainable through over-exploitation of ecological and environmental resources. However, these growths are unsustainable. Nor are they the type of growth China needs in the long run. In discussions about increasing total factor productivity, rigorous care should be taken to guard against the inclination to solely pursue economic and productivity growth.

In the above, we have given a brief analysis of the main sources of, and obstacles to, an increase in China's total factor productivity from the following perspectives: structural reform, technological progress, structure and factor allocation, social development, and restraints from environment and resource endowment, touching almost all aspects of the Chinese economy. It proves that improving total factor productivity calls for systematic efforts.

IV. Policy Suggestions on Improving China's Productivity

After taking the above five aspects—system reform, technological progress, structure and factor allocation, social development, and restricted resources and environment—into consideration, we gave a brief analysis of the main sources of and barriers to the growth of Chinese total factor productivity. The analysis incorporated nearly all aspects of the economic system, and indicated that the efforts to improve total factor productivity should be made systematically and the countermeasure should be adopted comprehensively. The following suggestions on how one might improve China's productivity stem from these two important discoveries.

1. Strengthening independent innovative ability and improving the competitive power of Chinese enterprises

The economic environment of Chinese enterprises has changed greatly since China entered the WTO. The opening of markets led to the unavoidable introduction of fierce global competition. The need for Chinese enterprises to improve under these current conditions, especially in independent innovation and development and in the influence of these enterprises on a global scale.

After China's reforms and the opening of its economy, technological progress has primarily depended on the importation of technology and the introduction of foreign investment; advanced technology in China is mainly controlled by foreign investors. The large amount of imported foreign capital has accelerated economic growth and technological progress and has contributed to the prosperity of China's economy. However, the industrial technology of Chinese enterprises is still relatively backward (their scale is small and their profitability is relatively low) and their economic strength cannot match that of the transnational corporations of the world.

Another change following China's entrance into the WTO has been the fast and continuous growth of exports out of the country. From 1978 to 2004, China's total import and export value increased 54.9 times, rising by 16.74% yearly and far exceeding the GDP average annual growth rate during the same period. However many scholars (including some foreign observers) point out that the exports of Chinese hi-tech and industrial products are monopolized by *foreign* corporations rather than Chinese enterprises. Chinese businesses rely seriously on industrial designs, key components and production equipment imported from the United States and other developed countries. They have not yet taken effective measures to absorb, digest, and popularize the imported technology domestically, failing to enable Chinese enterprises to compete with strong, global competitors in the short term.

In the 20th century, Latin American countries experienced a period of rapid economic growth and prosperity. However, since the 1970s, with the implementation of "new liberalism", "globalization" and "introduction of foreign capital", the invested economies of these countries have been tightly controlled by the international capital, causing a drain in profits. Consequently, the economic surplus of capital received by these countries is very small, causing some to name the trend of economic growth without development the "Latin American Phenomenon." Is the Chinese economy repeating the same trend? At present, some Chinese experts have warned that without the presence of several large domestic enterprises that possess advanced technology and have a high level of efficiency, China's economy

cannot sustain long-term prosperity. Thus, an over dependence on foreign capital and foreign technology will make it difficult for China to avoid the "Latin American Phenomenon." In order to avoid this, China must be vigilant in combating the hollowing out of domestic industries, lest it becomes the next "Latin American economy" hidden behind a high GDP growth rate, and should adjust its economic policies in the ways presented below.

1.1. Adjust the development strategy of over dependence on foreign capital, following the principles of promoting independent technological innovation and sustainable development.

Following reform, China attracted a large amount of foreign capital through preferential policies, which have played and continue to play a positive role in boosting productivity and accelerating economic development. However, we must also consider the enormous cost of these policies —excessive tax deductions and exemptions, the low or even zero cost of land usage, harm to the rights and interests of the labor that is provided so cheaply, low profits despite the advantage of the product price, the over expansion of the market, unequal competition between foreign and domestic capital—all of these factors have negative effects on the development of Chinese businesses and result in ecological and environmental problems, to name but a few.

Starting from 1992, FDI became the main way for trans-corporations to enter China's economic market. After 1998, the proportion of purely foreign-owned businesses in FDI increased at a steady rate. Consequently, many sectors and markets have become monopolized or controlled by trans-corporations.

Foreign corporations were allowed to invest in the domestic Chinese market in large numbers. From 1978 to the present, China has absorbed foreign investments of over US$500 billion (see Table 9), ten times that of Japan from 1945 to 2000. Given the degree to which China has opened its markets to foreign capital, one can see that it did not make the efforts to protect its domestic enterprises that Japan or Korea did.[6] On the contrary, China allows American and other foreign companies or joint ventures into the country to develop the new domestic markets, especially the markets for products with high added value, such as airplanes, software, industrial design, advanced machinery, semiconductor parts, integrated circuits, etc.

The high acceptance rate of foreign capital can be linked to the strategy of "exchanging market for technology", implemented in China to attract more advanced technology from abroad after the country joined the WTO (especially since the mid-1990s). The only prerequisite for the foreign corporations that wish to invest in China is that they ask it to open its domestic market. This "exchange market for technology" foreign policy involved constantly expanding the market in order to entice more foreign corporations to make investments in China, which in turn led to the ultimate introduction of advanced technology into the domestic sphere. After joining the WTO, the economic environment became increasingly ideal for investors as more and more trans-corporations invested, allowing for

[6] By contrast, there are many cases of discrimination in domestic industry and brand. For example, it is very difficult for domestic automakers to receive a production permit. Likewise, domestic builders of nuclear power plants are unable to obtain an order from the Chinese government because the government always gives priority to foreign manufacturers in order to receive more advanced technologies. This obviously does not favor the development and technical progress of domestic enterprises.

the growth of technology in China through the corporations' inner transformations. In 2002, more than 45% of imported technology was from this kind of technological transformation. During the transformation, it was difficult for Chinese enterprises to master key foreign technologies.

In practice, the "exchange market for technology" policy gained a certain degree of success. In fact, the implementation of this policy promoted Chinese industrial development for over 10 years, especially in the acquisition of low end product technology, improvement of technological ability and production capacity, and short-term economic growth. However, the policy has not yet achieved the anticipated economic results.

In accordance with the policy, foreign enterprises have not only obtained an enormous share of the market, but have also monopolized some domestic Chinese industries. Chinese enterprises have not obtained the basic and advanced technologies they need; at the same time, independent R & D and innovation improve slowly at best and are overly dependent on the technologies of foreign corporations in certain industries. China is fast becoming the largest manufacturing base in the world, but has not yet produced any large-scale manufacturing enterprise with a global reach. At present, most of the key technologies, brands, and marketing channels among the joint ventures in manufacturing in China, are still controlled by foreign corporations. The transnational corporations in China control key technologies and the production of key parts on the one hand, and control market channeling on the other, only shifting processing with low value-added to China's enterprises. The situation has been summarized as the foreign investor in China "taking out 30% of the capital, having 50% of the shares, and taking away 70% of the profits." Meanwhile, Chinese companies can only take away 30% of the profits. One expert estimates that during the course of production of an established brand to original equipment manufacturer (OEM), foreigners have taken away 92% of the profits, leaving China with 8% at most.

The development of the Chinese auto industry is a typical example of this trend. "Industrial policy of China's auto industry", issued in 1994, clearly emphasized the policy of "exchanging market for technology." It played a positive role in helping Chinese automobile enterprises bring in foreign capital and learn advanced technology and scientific management from foreign corporations. At present, foreign branded automobiles occupy more than 90% of the market in China. As they gradually lost hold over the market, Chinese automobile enterprises failed to learn the key technologies mastered by the foreign countries and had to pay brand-usage fees, technology transfer fees, and KD parts purchasing fees, thus reducing their own market competitiveness. With regard to profit distribution, the foreign corporations retained most of the profit shares, and transferred their profits to their respective home countries. The Chinese auto industry has developed through joint ventures for more than 20 years, but, without developing domestic R & D it has lost the opportunity to independently develop its own brands.

In order to solve the problem of over-dependence on foreign capital, the Chinese government must establish a "sustained development view" at all levels and abandon the notion that short-term achievement and economic growth must be achieved at any cost. As a socialist state, China ought to abandon short-term practices in favor of long-term development, construction of infrastructure, and promotion of innovative ability.

In the meantime, the government should recognize the advantages and disadvantages of utilizing foreign capital. Although foreign capital is currently the most important factor in spurring the growth of the country's GDP, China should be aware that, at present, it does not, on the whole, have a lack of capital. The fast growth of the economy and the high retention of capital allow China to have more than sufficient funds. In fact, the Chinese commercial banks often worry about the enormous surplus of savings over loans. In order to attract foreign capital, transnational corporations in many sectors enjoy more favorable policies which domestic enterprises—especially private enterprises—do not. Perhaps this kind of "unequal competition" is feasible for the time being when there is a shortage of capital, but it cannot be allowed to continue much further. Since the mid-90s, there has been very little change in the condition of capital shortages. After failing to achieve the aims of "exchanging market for technology," China must raise the threshold for the entry of foreign capital.

In addition, the degree of concentration of firms in many sectors in China is low; enterprises are large in number but small in scale, and the markets often appear disorderly or excessively competitive. The market structure of excessive competition leads to a shortage of enterprises with an advantage of economic scale and technological strength in the sector, which in turn leads to the easy entrance of foreign enterprises into the domestic market. Domestic enterprises in China suffer from excessive competition; in order to improve their own market status they agree to build a partnership with foreign investors and do not hesitate to sell their businesses at a low price and give up the independent brands[7]. This leads to the loss of state assets and turns the decision rights of some strategic industries over to foreign corporations. At present, foreign capital exists in many sectors and, as domestic Chinese enterprises continue to withdraw, there is slow growth and even negative growth in some sectors. There may be many reasons for this trend, but the "extruding effect" of a favorable policy to foreign capital is one of the most pressing. The "extruding effect" is particularly conspicuous in industries such as plastic goods, leather and furs, rubber goods, culture and education, sports goods, food processing, furniture manufacturing, clothing and fiber goods, etc.

There is no doubt that, in the long run, China should open up its economy further and take its own competitive advantage. But in the meantime, it should change its blind policy of importing foreign capital and properly raise the threshold of foreign capital. At the very least, the policy of importing foreign capital should be adjusted to allow for fair competition with domestic enterprises, which is essential for creating a friendly environment in which Chinese enterprises can flourish. In addition, the introduction of foreign capital should be properly controlled in order to encourage Chinese industrial and technological development. Doing so would alter the present excessive dependence on foreign capital and technology and would greatly help to establish an "endogenous pattern of economy.[8]" In short, these suggestions would be helpful in securing China's sustained economic development and avoiding economic risk.

[7] For example, the Shanghai Airplane Manufacturer tore down the production line of "Yun 10" airplane and began to assemble parts of MD airplane; the Shanghai Automobile Group stopped producing the "Shanghai" brand of cars (which had been produced for more than 20 years).

[8] Refer to the economies that depend mainly on domestic capital and domestic demand.

1.2. Cultivate independent technological development ability and brand marketing ability on the basis of self-owned capital

As the open market has enlarged, the presence of foreign companies in China has, in turn, increased. However, with the development of joint ventures, the balance of both sides shifted and the market became more and more unfavorable to Chinese corporations. The foreign investors transferred only peripheral technologies to Chinese businesses, limiting their access to key technologies. In order to stay on top of key technologies, foreign companies constantly upgrade their own technology. Foreign investors also limit Chinese access to management skills by transferring selling skills to Chinese enterprises while blocking marketing skills, thus actively fostering their own brand assets in the market. The foreign companies are able to openly practice these methods because foreign investors are constantly increasing capital and stock shares. Through utilizing their sheer capital strength, foreign investors leave Chinese firms with no way out.

Given the current situation of foreign investors manipulating Chinese enterprises, it is obviously quite difficult for Chinese enterprises to establish the resources needed for an independent research and development capability and an independent brand marketing ability. It would be foolish for any foreign investor to train Chinese enterprises to have both technological and management abilities, for this would allow Chinese enterprises to master these two strategic objectives and eventually control the key technologies and brands on the market. The greater the strength of the international investor, the less likely it is that Chinese enterprises will obtain these capabilities, assuming that the long-term strategy of international companies involves leading the international and Chinese markets. It is not uncommon for many of the domestic automobile companies in China to possess no key technologies and consequently lose their independent brands.

The strategy of "exchanging market for technology" has already become an afterthought. As long as foreign investors have the leading position in the market, Chinese enterprises have hardly any chance of winning control over the key technologies and brands. In order to cultivate domestic R & D, China must rid itself of the control of foreign companies and establish a team responsible for technological R&D and brand operation supported with its own capital.

It is possible for Chinese enterprises to form an independent program for R & D and brand operation. Foreign investors in China not only give skills training to technical personnel but also to managerial personnel as well. Why do they do this? They wish to lower costs and capture the Chinese market. Therefore, it is not surprising that the foreign companies continue to implement policies that facilitate their control of key technologies and their control of brands on the market. Chinese enterprises should utilize this free flow of professionals and establish a technological development team supported by China's own capital to make lasting changes and finally attain the key manufacturing technology and brand management skills that it needs. The criteria for success is not to have Chinese enterprises obtain some key technologies and brand skills for the short-term, but rather to establish a long lasting independent research and development ability within the country.

The Cherry Company in the Chinese automobile industry and the Huawei Company in the IT industry are examples of how domestic Chinese enterprises can achieve success in independent technological development. Both Cherry and Huawei are the dark horses of their respective sectors; they have no elements of foreign capital and have formed independent

technological development capabilities, thus establishing their brand names in their trade markets. The two companies share similar tactics: first, they utilize the effect of personnel flow to firmly fix the growth of independent development; next, they work ceaselessly to set up their respective brands. Their success stories show that being open to the international market and importing foreign capital is important for Chinese technical personnel to get the training and learning skills they need. However, the real secret lies in the strategic ideas and strong enterprising spirits of the Chinese government and Chinese enterprises.

Strengthening the digestion, absorption, and transformation of introduced technology and implementing imitative forms of innovation are some effective ways or shortcuts that Chinese enterprises can employ to improve their independent innovative ability with low expenditure on innovation and low risk. Following its economic reform, China has introduced a significant amount of technology from foreign countries, but most of it can only be used to improve production capacity, Over the past ten years, large and medium-sized Chinese enterprises have spent less than 10% of their technology import expenses on digesting, absorbing, and transforming information, which is far less than the percentage of expenses that the enterprises of OECD nations spend (their percentage typically accounts for 1/3 of the total cost of technology imports) and is also much less than that of South Korea and Japan in the 1970s and 1980s.

There are many reasons why Chinese enterprises invest so little on digestion, absorption, and transformation of introduced foreign technology, including insufficient incentives, the small-scale size of their enterprises, and insufficient innovative ability. However, the most important reason why China lacks the mechanisms for digesting, absorbing, and transforming introduced technology is that the government lacks the instruments needed to coordinate enterprises to realize such a much-needed national goal.

1.3. Deepen reform to create a favorable external condition and *providing an incentive mechanism for technological innovation*

In order to foster the technological development ability and brand marketing ability of Chinese enterprises, businesses must first deepen reform and create favorable external conditions and incentive mechanisms for technological innovation.

1.3.1 Deepen the state-owned enterprise reform

The most effective and lasting incentive for innovation is that of property rights. China is currently in a transition period and the property relations of enterprises are still immature and unstable. The governing structure of Chinese enterprises has not yet become aligned with international standards, and mechanical and systemic obstacles seriously restrict the improvement of independent innovative ability within the economy. The administrative and supervisory authorities of many enterprises lack clear strategies and plans for long-term development, and the long-term and high-input technological innovation also lacks an incentive mechanism. Priority is still given to short-term return on technology imports. China should put great effort into the establishment of a governing structure that accords with the rules of modern enterprise, thus creating the external environmental conditions and an incentive mechanism for technological innovation in enterprises.

Furthermore, in light of the fierce market competition, the historical burden of state-owned enterprises is a constant presence, directly influencing the development of the technological innovation of enterprise. It is estimated that central-state-owned enterprises still have nearly 1/3 of their original redundant staff. Since the end of the 1990s, a large number of state-owned enterprise workers have been laid off and it is still problematic for these enterprises to find a way to utilize their excess staff. Moreover, the burden of the state-owned enterprise society is still prevalent. Separating the function of the state-owned enterprise running "society" has brought certain achievements. However, the development has been imbalanced, and this has had a significant impact on the economic benefits that business has brought. The large number of non-performing loans and assets and bad accounts that history has left behind are yet another heavy burden that state-owned enterprises must bear. The statistics show that the book value of non-performing assets of national state-owned enterprises accounts for nearly 11% of all assets. Generally speaking, however, the actual figures are typically higher than the statistical book value.

1.3.2 The government should give strong support to technological innovation

Technological innovation is quite externalized, which makes it hard to satisfy the social demand by depending solely on the market mechanism. The government has the responsibility of establishing policies to support technological innovation. It should, for example, utilize economic means or administrative means to give the necessary support to the technological innovation activities needed by developing industries and national brands. In addition, the government should assist in organizing and overcoming problems which are difficult for individual innovators to solve. It should also give direct support to the practice of research and development related to state strategy, national long-term development, and national security. The Chinese government has not done enough to meet these demands thus far.

China must make continuous and tireless efforts to set up an independent innovative ability and brand ability for domestic enterprises. This not only calls on the strategic ideas and independent enterprising spirit of Chinese entrepreneurs, but also the support of the Chinese government. For example, the government should learn from the U.S. government by using government purchasing, and especially military purchasing, to support enterprises. The Chinese military should change their current strategy of purchasing foreign technology for the sake of short-term success in improving national defense and should instead form a technological demand market open to all Chinese enterprises, thereby using the government's substantial military budget to encourage enterprises to work hard towards promoting a research and development ability in independent technology. Furthermore, the government should guide enterprises by developing policies and instituting various kinds of awards that would improve independent domestic research and development and strengthen cooperation between production units, universities, and research institutions.

China should also change its discriminatory policy towards private enterprise. Currently, private enterprise has not enjoyed equal civil treatment and is discriminated against in many ways, including market access, taxation, loan grants, stock market access, imports and exports, government bidding participation, license applications, and eligibility for governmental plans, etc. The government ought to abolish the discriminatory policies and regulations against private enterprise and instead establish specialized agencies offering

special services and management to private businesses, thus encouraging the development of private enterprise. In particular areas, such as technological innovation and technological transformation, there is an even stronger incentive for private enterprise to participate, but private businesses have lacked powerful policy support all this time. Among the relevant technological innovation policies, the fund subsidy, tax allowance, and government procurement for private enterprise policies have been particularly inadequate. As a result, the channel for financing private enterprise is not efficient, and there is a fund shortage. Government procurement is far more favorable to state-owned enterprises. China's technological innovation policy is geared primarily towards scientific and technological enterprises, especially the technological innovations of small and medium-sized hi-tech enterprises; its concern for private manufacturing companies is not nearly enough.

The current national innovation system is still imperfect and has some obvious flaws, which have hindered China from realizing its economic development goals. For example, during the planned economy era, product development for manufacturing enterprises was undertaken by research institutes dissociated from enterprises, and the technological development and innovation activities were concentrated in institutes or universities outside the enterprises. After the reform of scientific and technical systems over the course of ten years, most scientific research institutions in every department of the manufacturing industry turned into scientific and technological enterprises. Very few scientific research institutions dealt with enterprises, and this caused the already weak R&D in industrial technology, national economic security and national defense security to weaken even further. Currently, China lacks a capable and stable research team that receives lasting funding from the state and is engaged in researching and developing strategic technology and common technology within the country. It is especially necessary that those enterprises that have no means to become engaged in the R & D of basic and common technology before competing with other enterprises, should receive support with such technology from the government in order to improve their technological skills.

1.3.3 Accelerate the transition of the government's function

The Chinese government remains very powerful at all levels of operation and is still the most important economic investor. The government's decision to invest still depends heavily on the will of the leader and lacks clear risk responsibility and restricting mechanisms. The phenomenon of inefficient governmental investment is quite widespread. The Chinese local governments all compete to attract foreign capital. Many reach the stage of "one who is hungry is not choosy about his food", and this results in the repeated introduction of foreign capital, and repeated construction, while the quality of the introduced foreign capital tends to decline.

The low technological innovation skill of Chinese enterprises is closely related to the small scale of Chinese enterprises. This kind of structure with a low degree of consolidation within industries is unfavorable for enterprises that wish to pass on technological innovation. The problem of small-scale enterprises has been linked to the local government's interference in the trans-regional merging of enterprises.

Reducing direct governmental interference or participation in microeconomic activity is an important step towards improving efficiency and productivity within the economy.

1.3.4 Further improve the protection of intellectual property rights

The lack of intellectual property protection in China is one of the stumbling blocks preventing the improvement of independent innovation skills in Chinese enterprise. At present China has already developed complete intellectual property right laws and regulation systems in accordance with international rules and has also formed an intellectual property protection system with administrative protection and judicial protection. What China has done for the intellectual property protection system in the past 20 years has already been accomplished in many overseas nations for the past 100 to 200 years. However, the work put into the intellectual property right protection system has had a tremendous effect on the Chinese economy. As a developing country, China has not easily accomplished these goals in so short a time. However, we can amass a large body of evidence proving that there is still much more work to be done to improve intellectual property protection. For example, pirating causes a large number of domestic software companies to give up independent research and development in the domestic market and instead encourages them to process goods for the foreign market in order to avoid the domestic pirate market. In addition, some inventors, writers, musicians, and name-brand companies (they only constitute a minority of Chinese enterprises), believe that the current system of intellectual property protection in China is still quite far from providing effective protection.

We should also consider that the promotion of intellectual property rights would also protect the technological achievements of the imitating innovators by ensuring that they will not be imitated illegally by other imitators and, at the same time, protecting the legitimate rights and interests of the leading innovators. This sort of protection could serve a realistic function in China today.

1.3.5 Perfect the mechanism of venture investment and financing

In order to encourage innovation, developed countries establish reasonably perfected venture investment and financing mechanisms that encourage both the enterprise and the individual to make venture investments in technological innovation. China's financial system lacks this kind of mechanism for allocating financial resources aimed at improving the efficiency of economic, industrial and product structure. It still does not have the conditions necessary for private capital to act as a venture investment agent, since the investor supported by government finance is still the primary source of venture investment in the country. China should develop venture investment trade and multi-level capital markets more energetically, while continuing to foster and perfect money markets of all kinds.

2. Actively increase educational development, and human resources development

According to demographic research, China is currently enjoying the largest workforce in its history. If the country is to make the most of the competitive advantage of workforce resources, it is essential that great efforts be made to improve the quality of the workforce. World development trends indicate that the success of a developing country in catching up with an advanced country is usually accompanied by a rapid development of education and the reduction of the discrepancy in workforce quality with that of the developed countries. Although the development of manpower resources and the accumulation of human capital has

already far surpassed level of school education in the world today, education is still the basis and the primary way in which China can develop its manpower resources.

According to traditional economic theory, the quality of human resources has a direct effect on productivity. The degree of education has a direct effect on the quality of labor and is therefore the driving force behind the increase in productivity. According to the modern theory of economic growth, human capital is identified independently, and has become one of the most important sources of economic growth. Because education is the primary way to increase human capital, the degree of education reached is often the main means through which one can identify and measure human capital.

China's education policy has constantly changed since the development of society and economy in the 1960s. Generally speaking, its education policy is quite effective. Its educational goals have developed rapidly and have played a positive role in raising its productivity. However, the principles and policies of its education system still have many imperfections, leading to a negative impact on educational development, which needs to be improved urgently.

2.1 The rapid development of China's educational aims has played a positive role in raising China's productivity

China is a country that places great importance on education – education is one of the primary concerns of the Chinese family. Following the foundation of the new China, the country has made great progress in public education, particularly in the past 20 years. As Table 3 indicates, the proportion of different education levels to total population reveals the increase in educational focus from 1964 to 2000.

The research of Shen Lisheng et al (1998) shows that the contributions of a quick increase of human capital stock (i.e. the stock of educational funds) in every Chinese economic sector to the increase in their value-added is remarkable. The growth of human capital stock in some sectors, such as communication, transportation, and commerce, can help to explain over half of the value-added growth . This growth of human capital stock is sometimes the most important source of value-added growth in some sectors, such as the commerce sector and non-material production sector.

When we combine Table 1 and the productivity data that UNIDO offers, we can see that the improvement in China's labor productivity matches the development of Chinese education, indicating that the two are highly related. From 1966-1978, China's labor productivity increased at its slowest rate (1.1% every year), which corresponds with the stagnancy of Chinese educational development during approximately the same period (1964-1982), when the population with a higher education increased especially slowly. China's educational plans entered into a rapid development period after the reformation and opening of the economy (from 1982-2000) and it was during this time that the illiteracy rate in China dropped rapidly while the proportion of the population attending schools of higher education rose rapidly. Labor productivity in China also increased quickly during this period, experiencing a growth of around 6% annually. The correlation between educational development and labor productivity change reveals that China's education not only generates an active impact on economic growth, but, at the same time, contributes significantly to the improvement of the country's labor productivity. China is currently pursuing the development strategy of

"revitalizing the nation through science and education," which will undoubtedly contribute in positive ways to the development of Chinese education, promote the further improvement of the country's productivity, and change the country's economic development pattern.

2.2 The main challenges faced in China's development of education and future educational policy changes.

Since the foundation of the new China, the last 20 years has been the period of the fastest development of the country's educational system. However, it has also been the period with the greatest number of problems facing this system. At present, the most outstanding of these is the shortage of public educational resources. The problem is two-fold: the total amount of educational funds allocated and, the structure of educational funding. The latter is especially apparent in the unfair distribution of educational resources, especially in regard to the educational funding of rural areas. In addition the focus on exam-oriented education is problematic, because of the consequent inability to meet the demands of social and economic development.

The reasons for the problems in Chinese education are complicated and come from multiple aspects, such as the historical influence of the imperial examinations system, changes in the educational policy, problems of school governance, and the pressure of future employment and development caused by unreasonable economic and social structures. The need to find a way of creating a suitable environment for educational development, and promote quality-oriented education through policy reforms, is a very real one.

2.2.1 Take positive steps to continue solving the problem of insufficient input in China's educational system.

Education has, by nature, a very strong externality and contributes to the public good. The government has a great responsibility in the development of the educational system, especially in the area of compulsory education, and, furthermore, must bear the burden of the investment. However, the reality is that the problem of insufficient input in education is difficult to solve in the near future, and the old difficulties facing the educational system are being continually criticized from all sides. With the continued rapid economic growth, China's public education funds are increasing constantly. From 1990 to 2000, public education funds expenditure rose from 56,900 million *Yuan* to 256,300 million *Yuan*. However, the proportion of public education funds expenditure in the gross national product dropped year by year in the early stages of the 1990s from 3% in 1990 to 2.44% in 1995 and began to rise after the mid 1990s, but only accounted for 2.90% until 2000, far from the 4% goal[9] set out in the 1993 education plan. According to World Bank statistics in 2001, in the year 1999/2000, public educational expenditure in high-income countries Australia, Canada, France, Japan, Britain, and the U.S.A., accounted for 4.8% of GDP and in low income countries Colombia, Cuba, Jordan, Peru, Thailand, Tunisia, etc., for 5.6% of GDP at mean value. Without any doubt, the basic way to increase the total amount of educational funds is to raise the proportion of public education expenditure in the distribution of national income.

[9] Term 43 of "Outline of Reform and Development of Chinese Education" issued by the State Council in 1993 stipulates, "To raise the public education funds expenditure in gross domestic product gradually to reach 4% by the end of this century"

The state-run education system under a planned economy has long had difficulty in meeting the demand for funding. With the popularization of education and the enlargement of its scale, ,the government faces various issues. On the one hand its input cannot manage educational demand on a day-by-day basis, while, on the other hand, it is difficult for non-governmental educational entities to enter China's educational market, thus further aggravating the shortage of educational resources. Since the mid 1980s, China has allowed different educational entities to run progressive schools, and begin to break into the single state-run education system. But the proportion of input in non-governmental education is still rather low, and the existing educational environment and investment structure has yet to become a favorable environment for the inflow of alternative sources of educational funding. Thus, the shortage of supply of educational resources is a result of systemic obstacles.

According to "Report on Chinese Education and Human Resources", published by the Ministry of Education in 2003, China has a large gap in education compared with developed countries. Since the 1990s, though, the development of higher education in China's mainland has been extremely fast, with the gross entrance rate into university surging from 5.78% in 1996 to 15% in 2002. This shows that China has entered a stage of fast development of higher education, but compared with the U.S.A., Russia, South Korea (whose gross university entrance rates are all over 50%), the gap is very obvious. The proportion of those with at least a high school level of education in the population of 25-64 year olds is 87% in the U.S.A. and 66% in South Korea (among them, the proportions of people with higher education account for 35% and 23% respectively), while in China the proportion was only18% in 2000. The data of the Fifth National Census shows that most (75%) of Chinese employees in 2000 had an educational level of primary school and junior high school.

Making the effort to solve the problem of insufficient input in education is an important task in closing the gap between China and other nations. The Chinese governments should conscientiously consider this issue at all levels, and should recognize the important role of education in realizing sustained economic development, and should cease pursuing only short-term economic growth and short-term achievements;, this, would allow the government to make great efforts to fulfill the promise of "revitalizing the nation through science and education".

To solve the problem of insufficient input in education the structure of national income distribution and financial expenditure must be adjusted, and the role of the government in educational resource distribution strengthened. The following items should be put on the state's decision making agenda as soon as possible. First, the state authority should clearly stipulate a minimum limit of educational operation expense in the expenditure of governments at all levels; second, the educational funds expenditure of the state and at the provincial level should be geared towards compulsory education. The most important issue is to create a standard minimum educational funds expenditure for primary and junior school students per capita annually nationwide. Based on this standard, governments at all levels can adjust supplementary funding in addition to the standard if needed (as in the case of more developed areas). China, then, must introduce legislation on the growth of input in education, and in the proportion of educational funds to gross domestic product.

In order to solve the shortage of educational resources caused by an imperfect system, the reform of the structure of education in China must be deepened. China should look into the multiple channels of active market participation, expand market access, absorb the supply of educational funds from the multiple resources, and create more educational opportunities for

society. At present, the scale of private education is still limited, and the number of students at private schools is only 0.6% of that at state-run schools. The role of market participation in education must be properly strengthened in order to change the public education investment system.

In order to achieve fairness and efficiency of educational resource distribution, the government and market should each play their own role. The government should regard the guaranteeing of funding of compulsory education as ultimately its liability, so as to achieve fairness in educational opportunity; at the same time the input of government in non-compulsory education should mainly focus on helping less prosperous regions and peoples to obtain equal opportunity in education. It should also use multiple indirect policy instruments and regulations to create a favorable environment for market participation. In order to create effective policies and regulations, tone must distinguish between the different attributes of public educational funding, semi-public educational funding and private educational funding. The government should guarantee the supply of public educational funding, withdraw from the supply of private educational funding, and regulate the supply of semi-public products, in order to expand social and market participation.

2.2.2 Realize the rational allocation of educational resources and put forth effort to solve the serious inequality problem in Chinese education

The problem of unbalanced allocation of educational resources is very prevalent in China. For historical reasons, there is a tremendous gap in the level of social economic development among Chinese regions and between urban and rural areas. This is one of the reasons for the unbalanced educational development in China. After 1949, under China's planned economy, the unbalanced state of educational resource distribution between China's western and the eastern regions, and between town and countryside changed to some extent. However, after China's reforms and its opening of its doors, the gap in economic development among regions grew bigger. This allowed the further unbalanced state of educational resource distribution between east and west, as well as between town and countryside. With regard to the shortage of supply of educational resources, the shortcomings of structural controls are now particularly urgent. Such structural shortcomings are reflected in the gap between basic education and higher education, between rural education and city education, between "key schools" and ordinary schools, and between developed areas and less developed areas.

The disparity of educational levels in China mainly appears between urban and rural areas. According to the data of the Fifth National Census in 2000, the average education level of the population of 15 year olds and above in the countryside is 6.85 years, 3 years less than that of the cities. Though the adult illiteracy rate has dropped by a large margin (8.72% in 2003), China's total illiterate population is still 85.07 million, 20 million of whom are between 15 and 50 years old. The campaign to eliminate illiteracy, therefore, still faces severe challenges and arduous tasks. More than three quarters of the illiterate and semiliterate populations in China are concentrated in the western countryside, the minority areas, and designated national-level poor counties. China's input in education is already insufficient in its total amount, but to further complicate matters, educational resources are mainly concentrated in the city and developed areas. As a result, educational development in the rural areas, especially in poverty-stricken areas, is extremely limited. This, in turn, further aggravates the problem of the slow accumulation of human capital.

The input gap in education among the regions appears obvious when one focuses on the problem. The ratio of per capita educational fund input in the eastern, the middle, and the western region in China expanded from 1:0.80:0.71 respectively in 1990 to 1:0.62:0.54 in 1995. This imbalance of educational funding input is the main cause of the obvious unbalanced conditions for operating schools in different regions. Taking the cost per student as an example, the ratio between developed areas to less developed areas is 3.9:1 units for higher education, 7.3:1 units for middle school, 8.8:1 units for primary school, and the ratio for "key schools" of the city to an average school of the countryside is more than 100:1.

The educational predicament in broad rural areas results from both the shortage of education funds and the inequality of educational opportunity. These systematic shortcomings are a result of the system of fund allocation set up in the 1980s which designated a hierarchal structure of funding in which local governments were in charge of basic education at the lowest level, and the state government was in charge of higher education. According to this system, the funds from state revenue are allocated to higher education, and compulsory education funds are mainly borne by local governments. This kind of allocation system means that county and township governments mainly focus on funding compulsory education, while the responsibility for elementary education falls on the village governments. In China, the majority of townships and counties face financial crises, so there is a serious imbalance between the financial responsibility and financial ability of their governments to fund education. At the village level the governments' financial resources are even more restricted. This seriously limits educational input and development in the countryside. It is very common in China that salaries of teachers in rural areas are far below the norm, and the basic conditions of rural schools cannot be guaranteed. This leads to the discontinuation of studies for many children who should be in school. Since the late 1990s, the central and provincial governments have implemented "the campaign to promote compulsory education of poverty-stricken areas" to improve the poor conditions of primary and junior schools by issuing specific funds from transfer payments. Since March of 2005, the policy of "free tuition and textbooks" has been implemented in more than 500 designated national poverty counties. The educational condition in the poverty-stricken areas has improved dramatically. However, the gap between town and countryside has not been changed drastically.

Education is the sector that displays the most inequality in China. Besides unfair distribution of educational resources, described above, the inequality of educational opportunity is still one of the more serious issues. For instance, the matriculation points for nationwide college entrance examinations in larger cities is lower than that in smaller cities. It is also the case that in the city the matriculation point is lower than that of the suburbs and counties. This means an urban candidate's chance of being admitted to college is much higher than that of a rural examinee, often by several times. The peasant worker in the city, and his children, are not able to enjoy the urbanite's welfare and educational opportunities. Though the problem of the peasant worker's children going to school has been solved to a certain extent, the conditions in which they are placed are still very different from those of the urbanite.

Equal opportunity in education is the foundation needed to guarantee an equal starting point for students as well as future equality in society. In order to solve the structural problem of education funding in China, the government should assign educational finances as fairly as possible. In addition, it should refrain from further aggravating the structural imbalance of education funding with preferential policies. The focal point of the government's concern should be to "provide timely help", but not "give an added grace to what is already beautiful". Thus, in order to guarantee all citizens equal educational rights, as stipulated in the

constitution, the government should change its policy of favoring the city when allocating public educational resources. Rather, it should pay increased attention to rural areas and to disadvantaged groups. Educational development should be at the forefront in further eliminating the dual social and economic structure in urban and rural areas. Much attention should be paid in educational development to creating equal opportunity in order to achieve equality in high-level and high-quality education.

Meanwhile, a series of system reforms and policies must be implemented to improve the system of education under the charge of local and village governments, including: (i) increasing the transfer payment of central authorities and provincial government to compulsory education, especially rural compulsory education; (ii) confirming the cost standard of compulsory education in different regions and progressively standardizing the system of financial transfer payment; (iii) setting up and perfecting the appropriation system of education funds, including the principle and standard of allocating funds to enable transparency of allocation, and regulation of the appropriation.

In addition, the tendency of education to be excessively commercialized, should be changed. The involvement of market mechanisms in education is conditional. The condition is that the educational activities of market-based operations must guarantee education as a public good, while pursuing efficiency and quality; otherwise the involvement of the market mechanism in education does not have legitimacy. Compared with private products and services in the free market environment, educational activities and teaching services have much stronger "externality". Therefore, to introduce the market mechanism in the field of education, one can only introduce some "composition" of the market mechanism in educational field, whose purpose is to improve the efficiency and quality of public education and improve the degree of "responding" of suppliers of public education to the demand for public education.

However, as the largest developing country in the world, China must fulfill certain objectives in its educational development in order to bring itself on a par with developed nations. To meet the challenge of international competition and guarantee long-term development, it must focus on the construction of a set of schools and disciplines that reach, or are close to, advanced international standards. It is obvious that educational resources cannot be distributed completely evenly. So at present, the question of how to best handle the balance between efficiency and equality is one that China faces in dealing with the allocation of educational resources.

With regard to compulsory education and higher education, the government's financial resources should be allocated to guaranteeing primary compulsory education in order to provide equal opportunities in early basic education. From here, the government should allocate the remaining financial resources to meeting society's demand for higher education. Though university education is not compulsory, tuitions for universities should depend on the entrant's income. Thus, poor students should pay less and not be left out of the university because of lack of funds. In order to maintain the balance of students in higher education between the rich and the poor and between urban and rural areas, multiple vehicles such as student loans, work study, state aid and others can be provided to guarantee that the poor student can attend university.

With regard to the imbalance between education in rural areas and in the city, the government's allocation policies and orientation should aim first to slow this expanding gap, and then work to progressively narrow it. At present it is essential to increase government

input in rural education to solve the serious educational crisis that faces the countryside. In order to accelerate the urbanization process, the Chinese authorities ought to offer national status to the peasant worker as soon as possible and ensure the ordinary laborer's rights and interests. Peasant workers should also get preferential and even free job training to improve their employment ability and income level so that they can advance in society. Meanwhile, education for the children of peasant workers should be progressively localized to better suit their needs.

Finally, with regard to the central and western regions and the eastern regions, it must be acknowledged that there is an objective regional disparity, and that this will exist for a long time – it cannot be solved in the short term by administrative means. However, the central government should implement a preferential policy and strategy in the west in the public sector, such as infrastructure construction and basic educational development. This is to ensure regional disparity no longer continues to expand, and to create conditions for narrowing the disparity in the future.

2.2.3 Strengthen professional education, and perfect the human resources market to meet the needs of a socialist market economy

The information from the Chinese labor market at present indicates that high-level professional personnel and senior skilled workers are very scarce. This has directly influenced the improvement of productivity in China. More and more transnational enterprises entering China have indicated that the shortage of senior managerial talent in China is a major issue. Meanwhile, many Chinese enterprises do not lack the funds, a good project, or even the technological development strength, but do lack the high level of skills to manage the project. A survey report (2005) on Shenzhen points out that the serious shortage of senior skilled workers has already influenced the advancement of product quality and the absorption of mature technology in that province. Sixty-eight percent of enterprises interviewed said it was difficult to recruit senior skilled workers who could solve production problems and raise productivity. At present, the demand for skilled talent in the labor market of Shenzhen is 105,000 workers, and only 53,000 qualified job applicants meet the required skill grade – alarmingly, a gap of more than 50,000 workers.

The educational level of China's workforce is relatively low, the majority lacking basic professional skills and job training before being assigned to duty. Thus, vocational and academic education should be regarded as equally important. Under the driving forces of financial investment, social entities (especially enterprises) should be encouraged to run vocational education programs. High school graduates should also be open to accepting vocational education through such measures as student loans. Vocational education and job training of the workforce before they are assigned to the job market should be further institutionalized through legal requirements, so as to improve the laborer's quality of work, and to meet the needs of a fast-developing society and economy. In addition, with the continuous advancement of technology, individuals must constantly refresh their knowledge and management skills in order to meet the needs of market competition and social economic development. In the long run, there will be a worldwide trend to combine re-employment training and on-the-job training to establish a system of life-long education in society, thereby allowing the entire country to become a learning society, and enterprises to become knowledge-based organizations.

Human capital is formed by the development of human resources. This requires the laborer to put in a large amount of capital and time in person. It is, therefore, necessary to have an effective mechanism for repaying the human capital, one which would encourage individuals to invest in human resources development. China is in transition from a planned economy to a market economy, and the human resources market is not perfect. It has not yet formed an effective income distribution mechanism which could correctly reflect the supply and demand and the value of talent. Positions which are important in the national economy, especially in the state-run sector, are not as well compensated as those in comparable positions in the market environment. This makes it difficult for the inflow of talent to proceed rationally, and to have a regulated distribution of talents.

At present, nearly all fields are in need of talent. However, the employment of university students is in itself quite difficult. The phenomenon of "talents left unused" existing concurrently with "talent shortages" is common in China. This is because the human resources market cannot effectively achieve the adjustment of demand and supply of talent. For this reason, the personnel system must be quickly reformed, and the flow of talent further drawn upon.

2.2.4 Upgrade the educational view, deepen educational reform, and change exam-oriented education into quality-oriented education

New China has been in existence for the past 50 years. Education has been assaulted by political movements three times: the movement of thought reforms and restructuring of university and college (rebuilding according to the Russian model), the movement against the right and "great leap forward", and the great calamity of "the Cultural Revolution". In the high tide of "the Cultural Revolution", Mao Zedong, the former leader of China, pointed out that "the university will do" Here, he is mainly referring to the colleges of science and engineering. Whether the universities of arts and letters can continue to survive in this environment is uncertain. These political movements have contributed to the loss of many outstanding talents, and have belittled the reverence for knowledge and intellectualism over time.

Recently some measures to "restore the old ways", such as the system of college entrance examinations from before the Cultural Revolution, have been resumed. But the structure of education is far from adapting adequately to a changing China. Even to this day, Chinese educational development has not done well in creating quality-oriented education, and integrating modern ideas and knowledge. Though the Chinese Government and education authority energetically advocate quality-oriented education, it seems that the reality is quite the opposite. Chinese education, especially basic education, regards examinations for entering school as the most important criteria in evaluating a student. The input in education leans towards the university, key schools and urban schools. This compels students to try to enter prestigious schools by every possible means. Some local governments even use the funds allocated for compulsory education to run the so-called "state-owned" and certain private-run "noble" schools that charge high tuition fees.

Insufficient input in education turns compulsory education into education for profit. The trend towards educational commercialization has led to rising tuition fees, which are becoming increasingly unrealistic. Under the pressure to achieve test scores, exam-oriented education is becoming a more serious matter. For example, in many places, kindergarten pupils will learn

to "add, subtract, multiply, divide" very early on. It is also very common that students lack sleep, do not attend festivals or holidays, are not allowed to watch TV, read the newspaper, listen to radio, or read a book outside of class. Students who are taught in this way possess the skills needed to pass examinations, but are deficient in their ability to learn outside of testing. In addition, it is common to find that teenagers lack sense, lack morals, have a weak will, suffer from bad health, find no pleasure in work, and lack social adaptability. The system seriously hinders the all-round development of the student. In China's higher education, though the problem of the exam-oriented education is not outstanding, the teaching of knowledge is emphasized rather than the development of the student's ability to learn. In addition, the material that students study in school has to a great extent been obviously divorced from the reality of society and the economy.

Implementing quality-oriented education is a comprehensive reform that involves multiple aspects of educational direction, educational function, educational systems and educational content and method. This is closely related to value orientation, gauging talent, development of the labor market, the personnel system, the examination enrollment system, and the country's development strategy. The government and various circles of society should all pay attention to the problem of quality-oriented education, and help create a good environment for implementing such education with the support of the whole society. The goal of educational development in China should be to work towards the cultivation of a moral, intelligent, physically fit and aesthetically qualified Chinese citizen, one who has a deep world perspective and a modern character, to satisfy the development demands of Chinese society and the Chinese economy.

In a word, China still needs to be devoted to the development of education for a sustained period, especially by increasing the input into rural education. China should also launch diversified forms of job training and vocational education according to market demand in order to promote the improvement of labor productivity, technological progress and economic development. Only then can China radically solve the problems of existence and development.

Appendix: Tables and Figures

Appendix Table 1: Annual change rate of total factor productivity, technological progress and technological efficiency of China (%): 1961-2000

Year	DGDP	DTFP	DTP	DTE	DKL	DLP	DTFP/DGDP
1962	3.23	4.20	1.50	2.60	-7.36	2.73	130.20
1963	5.75	7.20	-3.00	10.50	-5.23	3.33	125.20
1964	10.99	9.50	-4.20	14.30	-0.65	8.91	86.50
1965	10.16	4.40	-8.30	13.90	3.94	7.53	43.30
1966	6.62	-1.30	-3.40	2.20	6.78	3.86	-19.70
1967	0.16	-1.50	-0.20	-1.30	-0.96	-2.25	-940.60
1968	-3.19	-3.60	-5.50	1.90	-2.72	-5.48	112.70
1969	10.39	9.30	-2.20	11.80	-2.51	7.49	89.50
1970	6.44	-1.90	-9.50	8.40	8.63	4.10	-29.50
1971	4.51	-5.80	-3.80	-2.10	10.26	1.00	-128.60
1972	4.43	-3.10	-0.50	-2.60	7.09	1.24	-70.00
1973	6.37	-1.10	2.90	-3.90	7.31	3.26	-17.30
1974	1.79	-4.50	2.70	-7.00	5.49	-1.02	-251.70
1975	5.56	-1.50	-10.00	9.40	6.49	3.08	-27.00
1976	0.15	-3.80	-14.60	12.50	2.82	-1.97	-2,601.60
1977	6.02	0.40	5.50	-4.80	4.63	3.77	6.60
1978	0.22	-7.50	-8.90	1.60	8.64	-1.63	-3,384.10
1979	12.06	5.50	-0.90	6.40	7.07	9.88	45.60
1980	5.75	1.60	-3.30	5.10	4.92	3.82	27.80
1981	6.66	3.10	0.30	2.80	2.13	4.04	46.50
1982	9.11	5.10	0.70	4.30	3.05	6.30	56.00
1983	8.13	3.50	-1.40	5.00	3.93	5.15	43.10
1984	13.98	7.80	2.30	5.30	6.97	11.26	55.80
1985	3.02	-4.70	4.40	-8.70	10.62	0.48	-155.80
1986	10.45	2.00	-3.20	5.40	9.68	7.87	19.10
1987	8.18	0.30	6.30	-5.70	7.95	5.75	3.70
1988	4.27	-3.20	3.40	-6.40	7.16	1.83	-75.00
1989	-3.24	-8.30	-4.70	-3.80	4.15	-5.42	255.80
1990	8.58	3.30	-1.70	5.10	3.57	6.25	38.50
1991	12.09	5.70	0.40	5.30	5.99	10.57	47.20
1992	12.88	5.00	-0.70	5.70	8.60	11.51	38.80
1993	12.76	1.80	7.00	-4.90	14.08	11.48	14.10
1994	8.86	0.00	4.00	-3.80	11.75	7.72	0.00
1995	7.66	-0.40	6.20	-6.20	10.26	6.55	-5.20
1996	6.40	-1.70	11.70	-12.00	9.01	5.34	-26.60
1997	5.77	-2.30	13.50	-13.90	7.88	4.75	-39.90
1998	6.33	-1.60	11.30	-11.60	7.34	5.35	-25.30
1999	5.20	-2.10	9.10	-10.20	6.61	4.24	-40.40
2000	10.51	2.70	5.90	-3.00	6.58	9.37	25.70

Data source: UNIDO

Appendix Table 2 Accumulated change rate of total factor productivity, technological progress and technological efficiency of China (%): 1961-2000

Year	DGDP	DTFP	DTP	DTE	DKL	DLP
1962	1.032	1.042	1.015	1.026	0.926	1.027
1963	1.092	1.117	0.985	1.134	0.878	1.062
1964	1.212	1.223	0.943	1.296	0.872	1.156
1965	1.335	1.277	0.865	1.476	0.907	1.243
1966	1.423	1.260	0.836	1.508	0.968	1.291
1967	1.425	1.241	0.834	1.489	0.959	1.262
1968	1.380	1.197	0.788	1.517	0.933	1.193
1969	1.523	1.308	0.771	1.696	0.909	1.282
1970	1.621	1.283	0.697	1.839	0.988	1.335
1971	1.694	1.209	0.671	1.800	1.089	1.348
1972	1.769	1.171	0.668	1.753	1.166	1.365
1973	1.882	1.158	0.687	1.685	1.251	1.409
1974	1.916	1.106	0.705	1.567	1.320	1.395
1975	2.022	1.090	0.635	1.714	1.406	1.438
1976	2.025	1.048	0.542	1.928	1.445	1.410
1977	2.147	1.052	0.572	1.836	1.512	1.463
1978	2.152	0.974	0.521	1.865	1.643	1.439
1979	2.411	1.027	0.516	1.985	1.759	1.581
1980	2.550	1.044	0.499	2.086	1.846	1.641
1981	2.720	1.076	0.501	2.144	1.885	1.708
1982	2.968	1.131	0.504	2.236	1.942	1.816
1983	3.209	1.170	0.497	2.348	2.019	1.909
1984	3.657	1.262	0.509	2.473	2.160	2.124
1985	3.768	1.202	0.531	2.258	2.389	2.134
1986	4.161	1.226	0.514	2.380	2.620	2.302
1987	4.502	1.230	0.547	2.244	2.829	2.435
1988	4.694	1.191	0.565	2.100	3.031	2.479
1989	4.541	1.092	0.539	2.020	3.157	2.345
1990	4.931	1.128	0.529	2.124	3.270	2.491
1991	5.527	1.192	0.532	2.236	3.466	2.755
1992	6.239	1.252	0.528	2.364	3.764	3.072
1993	7.035	1.274	0.565	2.248	4.293	3.424
1994	7.659	1.274	0.587	2.162	4.798	3.688
1995	8.245	1.269	0.624	2.028	5.290	3.930
1996	8.773	1.248	0.697	1.785	5.767	4.140
1997	9.279	1.219	0.791	1.537	6.221	4.336
1998	9.866	1.199	0.880	1.358	6.678	4.568
1999	10.379	1.174	0.960	1.220	7.119	4.762
2000	11.470	1.206	1.017	1.183	7.588	5.208

Data source: calculated from Appendix Table 1 that UNIDO offers.

Appendix Table 3: Index of the change in total factor productivity for China and other countries/regions: 1962-2000 (1961=1)

Year	China	India	Indonesia	Korea	Average level of the four countries of Latin America	Average level of nine African countries
1962	1.042	1.004	0.937	0.995	0.986	1.046
1963	1.117	1.046	0.906	0.999	0.984	1.062
1964	1.223	1.082	0.915	1.020	1.016	1.099
1965	1.277	1.035	0.879	1.021	1.034	1.048
1966	1.260	1.000	0.883	1.037	1.063	1.067
1967	1.241	1.057	0.882	0.989	1.075	1.051
1968	1.197	1.100	0.958	0.965	1.113	1.084
1969	1.308	1.196	0.965	0.970	1.139	1.107
1970	1.283	1.182	0.945	0.950	1.159	1.100
1971	1.209	1.164	0.910	0.950	1.203	1.153
1972	1.171	1.134	0.878	0.932	1.221	1.196
1973	1.158	1.109	0.872	0.967	1.227	1.169
1974	1.106	1.073	0.816	0.963	1.251	1.142
1975	1.090	1.137	0.774	0.955	1.178	1.091
1976	1.048	1.120	0.739	0.991	1.191	1.099
1977	1.052	1.149	0.727	1.001	1.219	1.080
1978	0.974	1.157	0.735	0.995	1.233	1.097
1979	1.027	1.077	0.709	0.975	1.301	1.115
1980	1.044	1.126	0.692	0.893	1.297	1.125
1981	1.076	1.139	0.677	0.898	1.240	1.147
1982	1.131	1.163	0.631	0.908	1.178	1.138
1983	1.170	1.220	0.626	0.960	1.166	1.117
1984	1.262	1.243	0.631	0.988	1.220	1.159
1985	1.202	1.258	0.626	0.998	1.250	1.186
1986	1.226	1.287	0.627	1.043	1.286	1.219
1987	1.230	1.307	0.625	1.082	1.306	1.245
1988	1.191	1.337	0.632	1.109	1.278	1.241
1989	1.092	1.355	0.654	1.087	1.282	1.253
1990	1.128	1.326	0.668	1.083	1.259	1.284
1991	1.192	1.304	0.674	1.086	1.302	1.307
1992	1.252	1.305	0.674	1.064	1.330	1.307
1993	1.274	1.340	0.670	1.054	1.366	1.337
1994	1.274	1.352	0.664	1.071	1.380	1.378
1995	1.269	1.348	0.632	1.091	1.365	1.404
1996	1.248	1.379	0.632	1.094	1.391	1.461
1997	1.219	1.334	0.639	1.097	1.424	1.459
1998	1.199	1.330	0.569	1.025	1.408	1.474
1999	1.174	1.295	0.495	1.046	1.289	1.397
2000	1.206	1.255	0.512	1.118	1.317	1.407

Data source: calculated according to Appendix Table 1.

Appendix Table 4 Annual growth rate of GDP and its fluctuation: 1953-2000

Before reform			After reform		
Cycle No.	Year	GDP growth rate (%)	Cycle No.	Year	GDP growth rate (%)
	1953	15.6		1977	7.6
	1954	4.2		1978	11.7
1	1955	6.8	6	1979	7.6
	1956	15.0		1980	7.8
	1957	5.1		1981	5.2
	1958	21.2		1982	9.1
	1959	8.8		1983	10.9
2	1960	-0.3	7	1984	15.2
	1961	-27.3		1985	13.5
	1962	-5.6		1986	8.8
	1963	10.2		1987	11.6
	1964	18.3		1988	11.3
	1965	17.0	8	1989	4.1
3	1966	10.7		1990	3.8
	1967	-5.7		1991	9.2
	1968	-4.1		1992	14.2
	1969	16.9		1993	13.5
	1970	19.4		1994	12.6
4	1971	7.0	9	1995	10.5
	1972	3.8		1996	9.6
	1973	7.9		1997	8.8
	1974	2.3		1998	7.8
5	1975	8.7		1999	7.1
	1976	-1.6	10	2000	8.0

Data source: China statistics yearbook

Appendix Table 5 The rate of investment in China: 1980-2003 (%)

Year	1980	1981	1982	1983	1984	1985	1986	1987
Percent	34.9	32.3	32.1	33.2	34.5	38.5	38.0	36.7
Year	1988	1989	1990	1991	1992	1993	1994	1995
Percent	37.4	37.0	35.2	35.3	37.3	43.5	41.3	40.8
Year	1996	1997	1998	1999	2000	2001	2002	2003
Percent	39.3	38.0	37.4	37.1	36.4	38.0	39.2	42.3

Data source: China statistics yearbook

Appendix Table 6 Pre-tax profit rate in industrial sectors (%)

	1980	1990	1995	1996	1997	1998	1999	2000
National Total	*20.06*	*12.20*	*8.29*	*7.11*	*6.97*	*7.12*	*7.45*	*9.00*
Coal Mining and Dressing	4.59	-3.73	6.49	6.80	6.79	4.11	3.30	3.99
Petroleum and Natural Gas Extraction	37.23	0.13	10.40	11.77	12.58	12.46	15.13	38.20
Ferrous Metals Mining and Dressing	6.56	8.41	10.24	9.11	9.89	5.20	5.72	6.55
Nonferrous Metals Mining and Dressing	7.79	10.61	11.46	8.66	9.75	7.84	9.22	10.46
Nonmetal Minerals Mining and Dressing	..	12.71	11.45	11.14	11.59	6.97	7.15	6.21
Logging and Transport of Timber etc.	12.57	7.16	11.58	6.25	5.82	4.44	4.04	3.49
Food Processing	31.11	..	8.77	3.50	4.86	4.37	5.10	6.82
Food Production	..	11.42	9.61	8.98	9.41	6.39	7.40	8.90
Beverage Production	70.85	23.25	22.73	22.25	23.39	12.49	12.52	12.68
Tobacco Processing	723.98	294.68	142.78	131.10	117.20	46.57	44.54	44.24
Textile Industry	87.90	13.49	3.88	2.52	3.96	4.33	5.46	7.20
Garments and Other Fiber Products	93.08	..	13.27	13.34	13.34	7.43	8.32	9.77
Leather, Furs, Down and Related Products	53.44	..	11.16	12.79	11.67	7.10	6.98	8.47
Timber Processing, etc.	31.10	3.97	8.32	9.08	8.37	5.97	6.61	7.95
Furniture Manufacturing	25.07	8.42	12.82	12.96	12.27	8.57	8.12	9.17
Papermaking and Paper Products	30.80	..	10.53	10.43	8.30	6.15	6.56	6.92
Printing and Record Medium Reproduction	30.64	..	8.58	11.51	11.35	9.00	9.09	9.52
Cultural, Educational and Sports Goods	83.43	..	15.44	16.42	15.69	7.46	7.94	8.19
Petroleum Processing and Coking	86.72	27.28	19.81	16.25	14.62	9.67	10.04	9.66
Raw Chemical Materials and Chemical Products	21.59	17.99	10.31	9.04	7.27	5.65	5.73	6.55
Medical and Pharmaceutical Products	58.06	..	18.44	19.44	19.08	9.60	9.94	10.76
Chemical Fiber	32.71	21.24	10.47	6.23	5.87	4.54	6.34	8.14
Rubber Products	91.65	31.62	14.67	14.78	14.21	8.15	6.64	6.85
Plastic Products	46.71	11.67	6.99	7.69	7.65	6.85	7.12	7.65
Nonmetal Mineral Products	..	9.42	8.73	5.61	4.81	5.00	5.74	6.66
Smelting and Pressing of Ferrous Metals	17.78	16.51	9.22	5.80	4.49	4.53	4.66	6.18
Smelting and Pressing of Nonferrous Metals	16.92	13.08	10.37	4.44	4.11	4.92	6.37	7.77
Metal Products	35.06	17.47	11.16	8.38	8.10	6.46	6.88	7.51
Ordinary Machinery Manufacturing	15.13	9.32	11.69	8.87	8.32	5.45	5.67	6.38
For Special Purposes Equipment	..	..	8.33	6.96	7.07	5.10	5.42	5.85

Manufacturing								
Transport Equipment Manufacturing	12.94	11.45	14.11	10.73	10.46	6.31	6.86	7.30
Electric Equipment and Machinery	39.01	21.42	14.65	12.52	11.70	7.01	7.41	8.46
Electronic and Telecommunications Equipment	19.51	16.03	17.13	16.06	20.02	8.09	8.71	10.15
Instruments, Meters, Cultural & Office Machinery	27.16	13.05	8.61	7.38	8.45	5.13	5.89	7.71
Electric Power, Steam and Hot Water	15.31	9.93	7.22	8.21	7.46	7.78	6.72	7.18
Gas Production and Supply	10.41	1.70	-0.57	-2.17	-0.38	0.48	0.36	1.16
Tap Water Production and Supply	11.09	3.12	4.58	3.84	3.23	3.70	3.86	2.71

Data source: China Statistics Year Book

Appendix Table 7 Savings Rate(%): 1978-2004

Year	1978	1979	1980	1981	1982	1983	1984	1985	1986
%	37.9	35.7	34.6	32.5	33.7	33.8	34.5	34.3	35.4
Year	1987	1988	1989	1990	1991	1992	1993	1994	1995
%	36.8	36.3	35.9	38.0	38.2	38.3	41.5	42.6	42.5
Year	1996	1997	1998	1999	2000	2001	2002	..	..
%	41.5	41.8	41.3	39.8	38.9	40.2	42.0	..	..

Appendix Table 8 Growth rates of personal income and GDP (%)

Year	GDP growth rate	Resident income growth rate
1985	13.50	3.46
1986	8.80	4.25
1987	11.60	2.85
1988	11.30	-0.60
1989	4.10	-6.47
1990	3.80	8.97
1991	9.20	10.13
1992	14.20	7.19
1993	13.50	5.89
1994	12.60	9.48
1995	10.50	9.96
1996	9.60	11.08
1997	8.80	5.20
1998	7.80	4.83
1999	7.10	5.61
2000	8.00	3.63
2001	7.30	5.82
2002	8.00	8.04
2003	9.10	7.60
2004	9.50	7.20

Appendix Table 9 Actually used foreign investment (100 million USD)

Year	Total	Loan	FDI	Other investment
1979-1984	171.43	130.41	30.60	10.42
1985	44.62	25.06	16.58	2.98
1986	72.58	50.14	18.74	3.70
1987	84.52	58.05	23.14	3.33
1988	102.26	64.87	31.94	5.45
1989	100.59	62.86	33.92	3.81
1990	102.89	65.34	34.87	2.68
1991	115.54	68.88	43.66	3.00
1992	192.02	79.11	110.07	2.84
1993	389.60	111.89	275.15	2.56
1994	432.13	92.67	337.67	1.79
1995	481.33	103.27	375.21	2.85
1996	548.04	126.69	417.25	4.10
1997	644.08	120.21	452.57	71.30
1998	585.57	110.00	454.63	20.94
1999	526.59	102.12	403.19	21.28
2000	593.56	100.00	407.15	86.41
2001	496.72	--	468.78	27.94
1979-2001	5684.07	1471.57	3935.12	277.38

Data source: Ministry of Foreign Trade and Economic Cooperation.

Fig. 1 Trends of growth rates of the economy, total factor productivity, technological progress, technological efficiency, capital deepening and labour productivity (1961~2000)

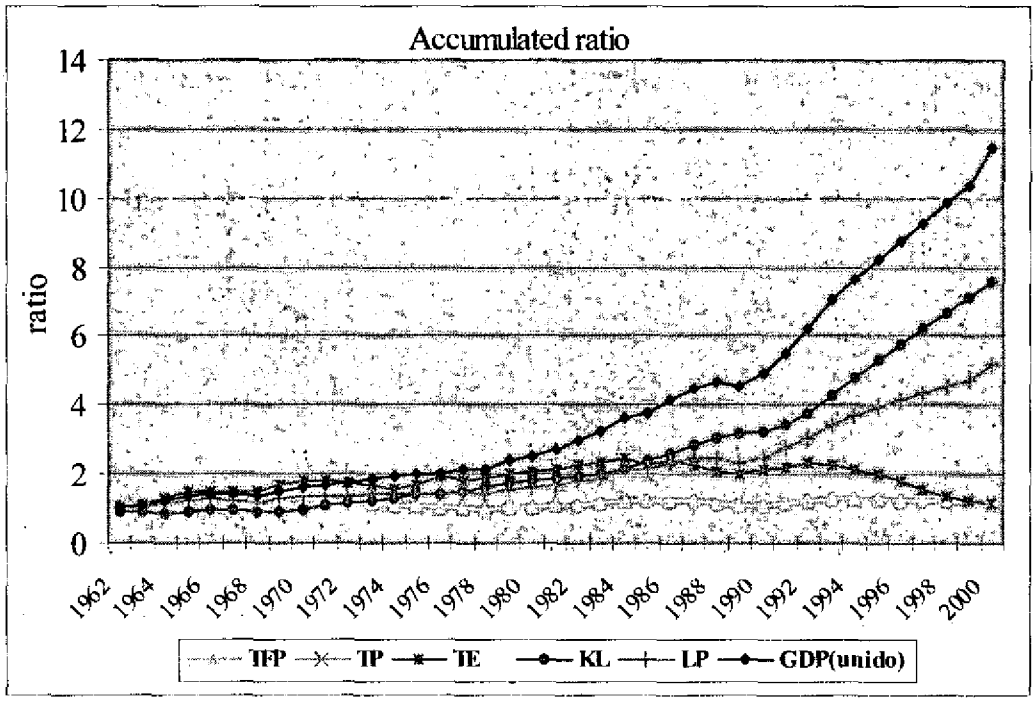


Fig.2 Trends of total factor productivity in China and other countries

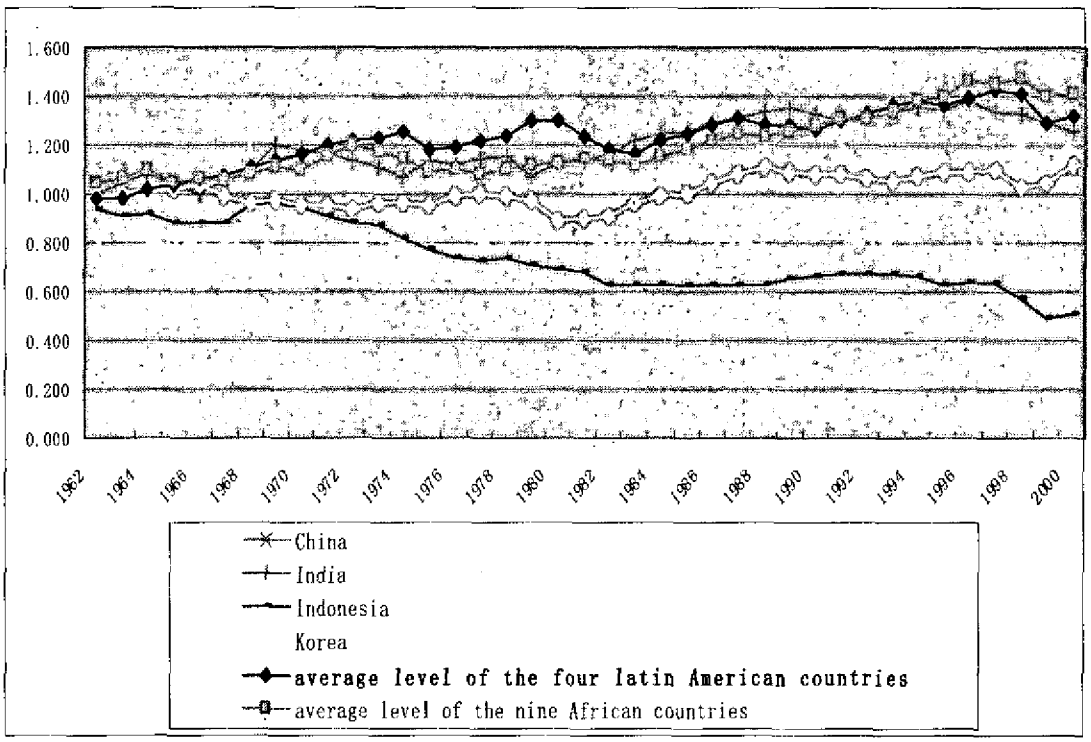


Fig.3 Trends of technological progress in China and other countries

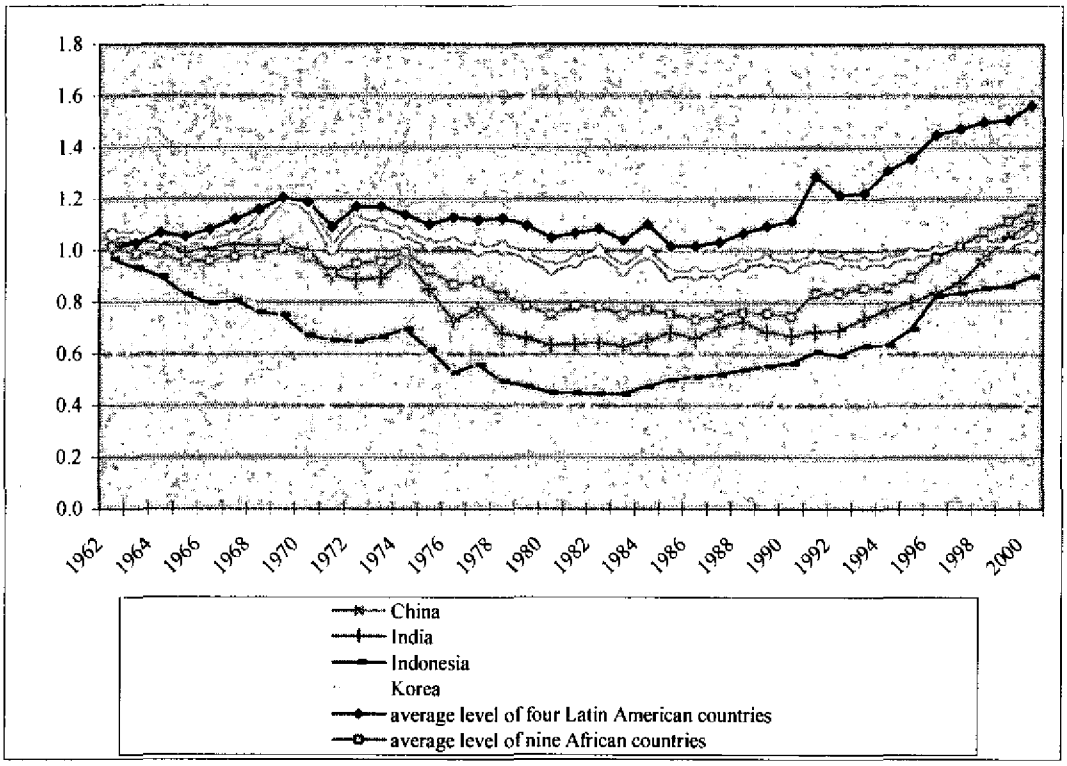
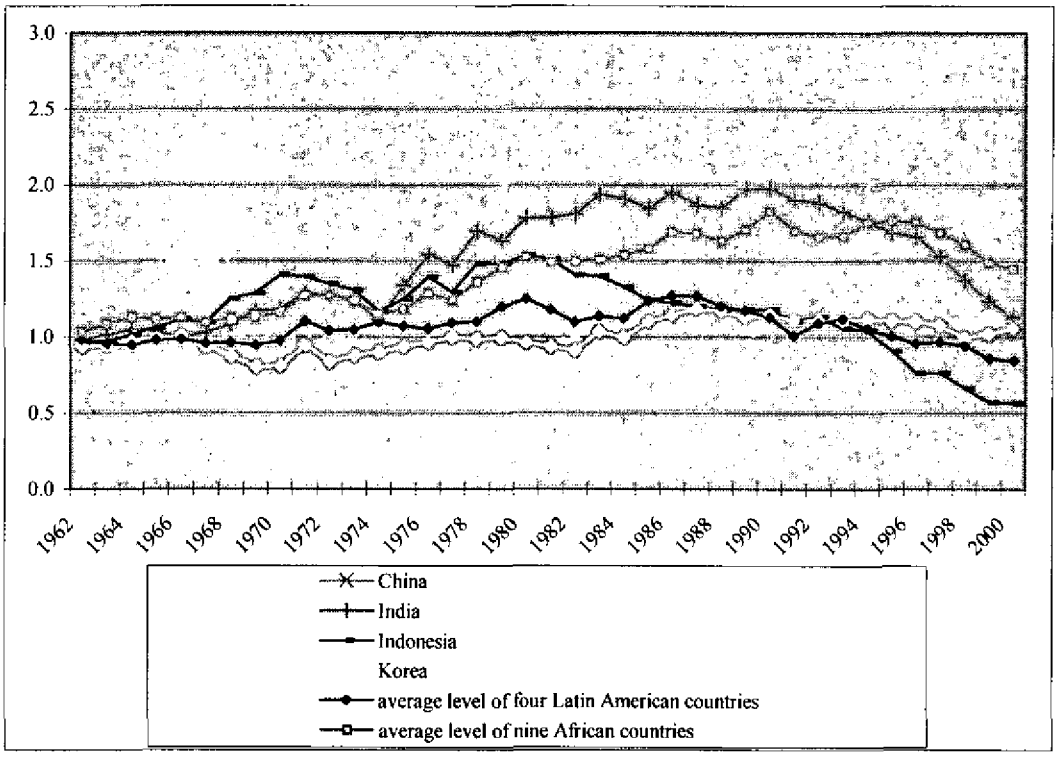


Fig.4 Trends of technological efficiency in China and other countries



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