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# CHINESE ECONOMIC GROWTH: SOURCES AND PROSPECTS

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## Abstract

China's impressive growth is rooted in the liberalization of a surplus labor economy that has a high saving rate. The reallocation of surplus agriculture labor to industry and service sectors generates a growth effect that shows up in total factor productivity (TFP) growth. Net TFP, the resulting residual, contains the true measure of technological progress (among other effects).

However, the analysis of China's growth is made difficult by a number of measurement problems. One mismeasurement is the calculation of growth rates with different base prices for different periods. A more serious mismeasurement concerns the value added in the industry sector, especially in its non-state component. Taking these and other mismeasurements into account, I calculated a range of estimates for each source of growth. I think that the official growth rates could be reasonably decomposed to:

| (in percentage points per annum) | 1979-93 | 1985-1993 |
|---|---|---|
| official growth rate | 9.3 | 9.7 |
| inconsistent use of base years | 0.2 | 0.3 |
| overstatement of industrial output | 0.5 to 0.7 | 0.9 to 1.2 |
| capital accumulation | 4.9 | 5.5 |
| labor force growth | 1.3 | 1.1 |
| reallocation of labor from agriculture | 1.1 | 1.3 |
| net TFP growth | 1.1 to 1.3 | 0.3 to 0.6 |

Most of China's TFP growth came from the reallocation of labor. It appears that unless there are significant reforms to the policy regime that was in effect in the 1985-93 period, the sustainable TFP growth rate is below 2 percent.

The Ninth Five-Year Plan specifies an investment rate of 32 percent to reach a target growth rate of 8 percent. My estimate is that this investment rate will produce a 8.1 percent growth rate. The closeness of my estimate to the target growth rate suggests that the government has assumed a TFP growth rate that is almost identical to mine, and that the government is aware that China's economic growth is mainly driven by the expansion of inputs.



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## 1. INTRODUCTION

China's economic performance since economic reforms were initiated in late 1978 has been truly impressive.[1] GDP grew 9.3 percent annually in the 1979-93 period: per capita net income of farmers increased by 239 percent, and the per capita income of urban households increased by 152 percent.[2] The incidence of absolute poverty declined dramatically in the rural area, from 33 percent in 1978 to 12 percent in 1990. This achievement must count as one of the most successful poverty alleviation programs in the twentieth century.

This paper analyses the growth experience of China in the 1979-93 period with the objectives of, one, assessing the likelihood of attaining the 8 percent growth target, and, two, venturing an opinion on policy measures that could enhance stable growth without raising the fixed asset investment rate. The paper is organized as follows. Section 2 identifies the mechanics of aggregate growth. Section 3 takes a closer look at economic growth in the agricultural and industrial sector. Section 4 identifies the forces that generated the growth examined in the preceding two sections. Section 5 reviews the main challenges for economic growth in China, and concludes the paper with an assessment of future economic growth.

To anticipate the conclusions, the paper finds that the fixed asset investment rate of 32 percent in the Ninth Five-Year Plan would allow the achievement of the 8 percent growth target. There is in fact a high probability that the actual growth rate would exceed 8 percent if the Ninth Five-Year Plan succeeds in establishing better market mechanisms and market institutions in more sectors of the economy, and hence raises the underlying rate of total factor productivity (TFP) growth.

## 2. THE SOURCES OF CHINESE ECONOMIC GROWTH

### Measurement Issues

Before undertaking the growth accounting, it is necessary to confront two measurement issues that exaggerate the official GDP growth rates. The first issue is the estimation of GDP growth on a consistent set of base-year prices, and the second issue is the calculation of real value-added in the industry sector.[3]

The official GDP growth rates are calculated from different base years, e.g. 1980 prices for the 1981-90 period and 1990 prices for 1991 onward.[4] The conversion of the pre-1990 growth rates to 1990 basis will lower the growth rates in the earlier period because of the interaction between two developments. First, the ratio of agricultural price to industrial price was higher in 1990 than in 1980. Second, the industrial sector was the biggest contributor to economic growth in the 1985-1993 period. The negative movement in the agriculture-industry price ratio means that the growth of the industrial sector in the 1985-90 period will be smaller when measured in 1990 prices than in 1980 prices.

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[1] See Sachs and Woo (1997) for a survey of the main competing interpretations of China's growth experience.

[2] After the completion of this paper in October 1995, revised estimates of GDP and its components were released in the 1995 Statistical Yearbook of China issued at the end of 1995. The old growth rates do not differ significantly from the revised growth rates. This paper uses the terminology that when the average growth rate for a period is given, the levels used in the calculation include the year before the period, e.g. the average 1979-93 GDP growth rate used the 1978 GDP level in its construction.

[3] More complete discussions of the problems with the Chinese statistical system are World Bank (1992) and (1994).

[4] See page 54 of Statistical Yearbook of China 1994.

All real GDP (and their component) figures reported in this paper are based on 1990 prices. Columns (1) and (2) in Table 1 report, respectively, the official and consistent GDP growth rates. As expected, the re-calculation of GDP on a consistent set of base prices causes the average annual growth rate in the 1985-93 period to go from 9.7 percent to 9.4 percent.

The second mismeasurement is much more serious: the growth of the industry sector has been exaggerated in the official data. The construction of value-added in the industrial sector is, in broad strokes, done as follows. Every enterprise reports three series to the State Statistical Bureau (SSB): gross output value in current prices, gross output value in base-year prices, and value-added in current prices. SSB then constructs an implicit price deflator from the first two series and uses it to deflate the third series to arrive at value-added in base-year prices.

One main drawback of the system is the reporting of gross output value in base-year prices. The SOEs, after long years of operation under the central planning system, are familiar with the correct calculation of this series. The COEs that have flowered since 1984 are much less clear about how to do the computation, especially because the base-year (until 1990) was 1980 when most of them were not in existent. Since the COEs are not supervised by the central ministries, they are under less pressure to report the real series accurately. So, many COEs have reported identical figures for the gross output in current prices and gross output in base-year prices, either out of ignorance or out of convenience.

There is also the incentive problem about accurate reporting. The fact is that gross output in base-year prices has neither operational nor financial significance for the enterprises, it has significance only for their supervising bureaux. Since supervising bureaux like to report high growth performance to their head office, which can be interpreted as evidence of superior management ability, the enterprises have the incentive to oblige their supervisors. The result is that:

> "Many counties in China...overstate production figures so that they can be reclassified as towns, which benefit from added political and economic clout. And promotions for managers throughout much of the country's state-owned industry are based on output, not profit..... When Jiangsu...persisted in reporting unusually high output numbers last year, [SSB's] auditors discovered that many poorer inland townships were systematically over-reporting production to keep up with booming townships along the coast."[5]

Another difficulty with the data on gross output in base-year prices is that the statistical system is flawed in its treatment of new products. It involves an estimate of what its base-year price would have been given its "quantity" attributes e.g. how many 286-chip is equivalent to one pentium chip in operational capacity. In response to the complications involved, a common practice by enterprises is to report the value of new products in current prices as the value in base-year prices. This over-statement of the real value of new products applies to statistical reports filed by both the SOEs and the COEs.

The by-product of all these tendencies to exaggerate the growth of real gross output is that the implicit deflators for the industrial output of SOEs and COEs consistently rose less than the factory-gate price index of industrial output, which is based on surveys of the prices (plan price and market price) received by a sample of industrial SOEs, mostly medium and large, for their products. (The term "factory gate price index" is the direct translation from the Chinese term, but the Statistical Yearbook of China 1994 translates it as "Industrial Products Producer Price Index," see Tables 8-15 and 8-16.)

Table 2 illustrates the difficulties of calculating real value-added in the industrial sector. Part A

[5] The Asian Wall Street Journal Weekly, January 30, 1995, "China's Politics, Inaccurate Methods Hinder Statistical Analysis of Economy."

presents four price indices for industrial products from different sources, and Part B presents the rates of change of these price indices. Column (1) is an implicit deflator derived from the official GNP data, it is calculated from the nominal and real figures on value-added in the industry sector. Column (2) is also an implicit deflator and it is calculated from the official data on nominal and real gross industrial output. The close correspondence between column (1) and column (2) confirms the use of the latter in deflating nominal value-added.

Column (2) is the weighted average of two implicit deflators, the deflator for industrial SOE output and the deflator for industrial COE output, columns (3) and (4) respectively. Columns (3) and (4) are constructed from the gross output value in current prices and gross output value in constant prices reported by industrial enterprises. Column (5) is the factory-gate price index.

The important thing to note is that the deflator for industrial COE output is unusually sluggish in the post-1984 period compared the deflator for industrial SOE output, the factory-gate price index of industrial output, and (not shown) the modified consumer price index.[6] In the 1990-93 period, the industrial COE output deflator rose 6 percent while the industrial SOE output deflator rose 35 percent, the factory-gate price index of industrial output rose 41 percent, and the consumer price index rose 26 percent. These figures support the widespread feeling that real value-added in the industrial COE sector is significantly exaggerated (especially, in the recent period) because of the reasons given earlier.

Part C of Table 2 shows the different levels of value-added in the industrial sector in 1990 prices obtained with the five price indices of Part A. Part D gives the growth rates of industry value-added. Real value added in 1993 is 5.1 times the 1978 level according to the official data, but is only 3.5 times when output is re-valuated using factory-gate prices. This disparity is the result of the interaction between the greater exaggeration of real COE industrial output and the rapidly growing share of COEs in total industrial output.

If the factory-gate price index were correct, then the official growth rate of the industrial sector in 1993 overstated the actual growth rate by 10 percentage points, see columns (3) and (5) in Part D of Table 2. Because the industrial sector was the biggest contributor to GDP growth, the re-valuation of real industrial output at factory-gate prices would lower the 1993 official GDP growth rate from 13.4 percent to 8.9 percent, see column (3) of Table 1. The sub-period GDP growth rates after the adjustments for base year changes and inadequate deflation of industrial output are:

GDP Growth Rates With Different Deflations of Industrial Output

| | 1979-1984 | 1985-1993 |
|---|---|---|
| | (in percent) | |
| official data | 8.9 | 9.7 |
| consistent base year (1990 prices) | 8.8 | 9.4 |
| consistent base year (1990 prices) with re-valuation of industrial output using factory-gate price index | 8.9 | 7.5 |

The important result from the re-valuation of industrial output is that there may not have been an acceleration in the 1985-93 average annual GDP growth rate from the 1979-84 average annual growth rate.

[6] The consumer price index is based on from price surveys. The consumer price index started in 1985, I constructed the modified consumer price index by grafting on the pre-1985 rates of increase in the retail price index.

Inadequate deflation of industrial output could have added as much as 1.9 percentage points[7] to the average growth rate of the 1985-93 period.

A word of caution is necessary at this point to set the correct way to interpret the results of this paper. This paper has not proved that the official measurement of non-SOE industrial output is incorrect because it has not proved that there was no change in the terms of trade between SOE industrial output and non-SOE industrial output. The industrial output of SOEs and non-SOEs may be sufficiently non-overlapping and non-substitutable that the more rapid growth of the latter has caused the terms of trade to move against non-SOE industrial output. Furthermore, the paper has not proved that the factory-gate price index is the correct price index to use.

Given the data problems identified above necessary, point estimates of average GDP growth and average TFP growth are less useful than the respective plausible ranges within which the true means lie. Thus, this paper will calculate point estimates and the plausible ranges of these point estimates. In short, this paper acknowledges the data measurement problems that are well-known and recognized by the State Statistical Bureau of China, and attempts to estimate the magnitudes of these data problems.

The correct way, therefore, to look at the preceding GDP growth rates (and the subsequent estimates of TFP growth rates) is to regard them as the upper and lower ends of the respective plausible ranges within which the actual GDP (and TFP) growth rates lie. The upper end of the estimates on GDP growth is given by the official data (re-calculated on a consistent base year) and the lower end of the estimates is calculated by re-valuing industry output with the factory-gate price index.

One important issue that needs to be clarified here is the possibility of a relationship between the estimated GDP level and the estimated GDP growth rate. As is well-known, the actual level of GDP may be understated by official data. The point that must be understood is that the understatement of the level does not automatically mean that the official growth rate is also understated. Unless it can be shown that the unmeasured part of GDP has been growing consistently faster than the measured part, one could not conclude that the official growth rate is an understatement. One could in fact argue the opposite: the existence of unmeasured economic activities means that an improving statistical reporting system would begin to count them, treating the existing activities as new activities, and hence exaggerate the growth rate. So an understated level of GDP is likely to produce an overstated rate of GDP growth as data reporting improves over time.

Given the various factors that bias the estimate of GDP growth rate in opposing directions, it is important to bear in mind that the aim of this paper is to provide respective plausible ranges for the average GDP and TFP growth rates and not just point estimates of them. The terms of trade might had indeed turned against COEs' industrial products, such that the use of the factory-gate price index would understate the quantity of industrial output produced. But the improvements in China's data collection could exaggerate output growth by counting existing activities as new activities.

## The Delineation of Growth Phases

China's economic growth can be divided into two analytical phases by their sources of growth. The first phase is the 1979-84 period where the agricultural sector was an important contributor to growth. Comprehensive liberalization of the primary sector was initiated at the end of 1978 by expanding the use of agricultural markets, and decollectivising agriculture. Some production incentives (notably, profit-retention and bonus) were introduced for some classes of secondary and tertiary activities during the first phase of reform. The average annual growth rate for the 1979-84 period was 8.8 percent. Agriculture and industry

[7] This number is different from the implied number of the preceding figures because of rounding errors.

made almost equal contribution to the output expansion, 32 percentage points and 34 percentage points respectively, see Part 1 of Table 3.

The impressive growth of the first phase led to broader liberalization of the secondary and tertiary sectors in mid-1984. The most radical liberalization occurred in the rural areas with the lifting of restrictions on the formation of community-owned production units, the TVEs.[8] The SOEs, located mainly in urban areas, were liberalized by devolving to them some decision-making power from the supervising industrial bureaux.

The average annual growth rate in second phase, 1985-93, was 9.4 percent. Industry accounted for 57.5 percent of the increase in output; and the tertiary sector greatly out-stripped the primary sector in terms of contribution, 25 percent versus 12 percent. The biggest contributor to GDP growth is the industrial COE sector, 29 percentage points. Industrial individual-owned enterprises accounted for 8 percentage points of the aggregate output growth.

It is important to stress however that the conventional view regarding the sources of growth in the 1985-93 period remains unchanged after re-valuing industrial output with factory-gate prices, see Part 2 of Table 3. Industry now accounted for 47 percent of the output expansion, the tertiary sector for 31 percent and the primary sector for 14 percent. The industrial sector remained the chief engine of growth, and the non-state sector was in the driver seat.

The leading role of the industry sector in GDP growth since 1978 (even more so since 1984) places China's economic growth within the context of traditional economic development. The unusually large contribution of the tertiary sector to China's growth places China's experience within the context of economic transition from traditional central planning. Central planning has traditionally regarded service activities as "unproductive",[9] and hence has suppressed them. The rapid development of the service sector after 1978 reflects its relative underdevelopment because of its prior suppression.

## The Mechanics of Growth

The growth accounting exercise is based on the three sectors -- primary, secondary (industry and construction) and tertiary -- as defined by Chinese statistics. Each sector is assumed to be characterized by a Cobb-Douglas production function, and the result is:

$$Y = \sum(\alpha_i x_i^{\beta_i} z_i^{(1-\beta_i)}) L^{\beta_i} K^{(1-\beta_i)}$$

where
- $Y$ = GDP
- $L$ = total labor force
- $K$ = total capital stock
- $w_i$ = sector i's share of GDP
- $x_i$ = sector i's share of labor force
- $z_i$ = sector i's share of capital stock

sector 1 = primary sector (agriculture, forestry and fishing),
sector 2 = secondary sector (industry and construction)

[8] Given that the unleashing of the rural TVEs brought great dynamism to the economy, it is hence not right to characterize phase two, as some have done, as reforms of the urban sector.

[9] Most service activities are not counted in Net Material Product, the aggregate income measure used in socialist economies.

sector 3 = tertiary sector.

GDP growth can be decomposed into portions that are due to capital accumulation, labor force growth, and total factor productivity (TFP) growth:

$$(dY/Y) = (dL/L)\sum w_i\beta_i + (dK/K)\sum w_i(1-\beta_i) + \sum w_i\beta_i(dx_i/x_i)$$

$$+ \sum w_i(d\alpha_i/\alpha_i) + \sum w_i(1-\beta_i)(dz_i/z_i)$$

where: TFP Growth $= \sum w_i\beta_i(dx_i/x_i) + \sum w_i(d\alpha_i/\alpha_i) + \sum w_i(1-\beta_i)(dz_i/z_i)$

TFP growth is in turn partitioned into, what we call here, labor reallocation effect and net TFP growth:

labor reallocation effect $= \sum w_i\beta_i(dx_i/x_i)$

net TFP growth $= \sum w_i(d\alpha_i/\alpha_i) + \sum w_i(1-\beta_i)(dz_i/z_i)$

Net TFP growth is the residual that contains technological improvements.

Labor reallocation is singled out for attention because the bulk of the Chinese labor force is peasant farmers, a third of whom lived below the absolute poverty line in 1978. Sachs and Woo (1994) have argued that this "surplus labor" feature[10] has made China's transition from centrally planning fundamentally different from the transition of Central and Eastern Europe and the former Soviet Union (CEEFSU). Specifically, they argued that the marketization of a centrally-planned economy means normal economic development for China but structural adjustment for a CEEFSU country. The intersectoral shift of labor (away from agriculture) increases aggregate output when the marginal product of labor (MPL) in the primary sector is lower than the respective MPLs in the secondary and service sectors. Chow (1993) found the marginal value product of labor in 1978 to be 63 yuan in agriculture, 1027 yuan in industry, 452 yuan in construction, 739 yuan in transportation and 1809 yuan in commerce.[11]

There could have been further refinements to the preceding decomposition formula but the absence of data prevented them. Net TFP could have been decomposed further; for example, to get the contribution from the intersectoral shift of capital, and the contribution from change in ownership structure. But both of these contributions would require making bold assumptions; the first would require knowledge about the sectoral distribution of capital, and the second would require knowledge on the distribution of capital and labor by ownership in each sector.

Given the unreliability of data on the sectoral distribution of capital stock, upon which estimates of sectoral $\beta$'s would have to be based, we drew upon the production function literature on China to generate a range of TFP growth rates by using different values for different values of a common $\beta$; specifically, $\beta$ =0.4, 0.5, and 0.6. I rely on Li Jing Wen's (1992) estimates of the capital stock for the growth accounting. I use compound rates of growth instead of the arithmetic average growth rates in the analysis.[12]

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[10] Agence France Press (December 7, 1993) reported the Agriculture Minister Liu Jiang as saying that there were 150 million excess farm workers (out of a rural labor force of 450 million).

[11] Figures are expressed in 1952 output values.

[12] The difference between them is minuscule e.g. the compound growth rates of GDP are slightly lower than the simple arithmetic average growth rates by about 0.05 percentage points.

The growth accounting exercise is conducted for the entire 1979-1993 period and for two subperiods, 1979-84 and 1985-93. The delineation of the subperiods correspond, one, to the policy regime change toward accelerating reforms in the nonagriculture sectors, and, two, to the emergence of industry as the undisputed primary engine of growth. The growth performance of the 1985-93 subperiod may be a better guide (than that of the entire period) to understanding the future growth prospects of China. This is because future Chinese growth is likely to be led by the agricultural sectors as in the 1985-93 period.

Table 4 reports the contribution of each factor to growth. A range of estimates for each contribution was generated by the two ways of constructing real industrial output (official method and factory-gate prices method) and the three values of $\beta$ (0.4, 0.5 and 0.6). China's high investment rate and low initial capital stock caused the capital stock to grow 9.8 percent annually in the 1979-93 period. Capital accumulation was responsible for 3.9 to 5.9 percentage points of the GDP growth rate; and labor force expansion was responsible for 1.1 to 1.6 percentage points. This meant that TFP growth contributed 1.1 to 3.6 percentage points to the 1979-93 GDP growth rate.

The 1985-93 subperiod in Table 4 is interesting in that during the period when industry was the major source of growth, capital accumulation accelerated to raise its growth contribution to the 4.4 - 6.6 percentage point range from the 3.2 - 4.9 percentage point range of the 1979-84 subperiod. The slowdown of TFP growth is real, it is not the result of data adjustment or of different $\beta$ values, e.g. TFP growth calculated from official GDP data dropped from 3.2 percent to 2.6 percent when $\beta = 0.5$. The biggest drop in TFP growth occurred in the case of industrial output deflated by factory-gate prices and $\beta = 0.4$; from 2.8 percent in 1979-84 to -0.1 percent in 1985-93.

Table 5 decomposes TFP growth into the labor re-allocation effect and net TFP growth. It should be noted that the official data on sectoral distribution of labor should be used critically. The official estimate of labor in agriculture is based on registered residency status, it is an overstatement because of illegal rural migration, especially to coastal TVEs. The official estimate of the size of illegal migration is 80 million and the World Bank's highest estimate is 150 million. The official estimate (80 million) does not include the 20 million people who migrate within their home districts.[13] In light of this data problem, two sets of estimates for labor reallocation effect and net TFP growth are conducted. The first set reported in Part A of Table 5 gives the minimum value of the labor reallocation effect by using the official figures on the sectoral distribution of labor. The second set reported in Part B of Table 5 assumes illegal rural migration to be 100 million since 1984, with 60 percent of the migrants ending up in industrial jobs.[14]

Part A of Table 5 reports that labor reallocation added only 0.5 to 0.7 percentage points to the 1979-93 growth rate. Furthermore, it shows that the labor reallocation effect is weaker in the 1985-93 subperiod. This smaller labor reallocation effect is contrary to the evident increasing outflow of agriculture labor after 1984 with the steady liberalization of regulations governing TVE establishment and activities e.g. TVEs being free to participate directly in international trade from 1987 onward. This contradiction suggests that the official data on sectoral labor distribution must be adjusted to reflect the illegal migration that has occurred, i.e. at least making use of the official estimates of the size of the "floating population."

The important finding in Part A of Table 5 is that the previous fining in Table 4 of the fall in TFP in the 1985-93 subperiod cannot be explained by the diminishing of the labor reallocation effect. Net TFP fell in the 1985-93 subperiod when official GDP data and official sectoral labor distribution data are used, regardless of the value of $\beta$. In short, the finding of a decline in technological improvements in the second

[13] Far Eastern Economic Review, "Irresistible Force," April 4, 1996.

[14] The sum of the official estimate of 80 million who moved out of home district and the 20 million who moved within their home districts.

subperiod is a robust one.

Part B of Table 5 reports that the labor reallocation effect increased the GDP growth rate by 0.9 to 1.3 percentage points in the 1979-93 period, and by 1.0 to 1.6 percentage points in the 1985-93 subperiod. The result is that net TFP growth is 0.2 to 2.3 percent for the entire period, and -1.1 to 1.9 percent for the second subperiod.

I draw three conclusions from Tables 4 and 5. The first conclusion is that the appearance of three cases of negative net TFP growth in the 1985-93 subperiod suggests that the use of the factory-gate price index may have understated the real amount of industrial output. The explosive growth of TVE output is likely to have worsened its terms of trade vis-a-vis SOE output. It is possible that 1985-93 GDP growth may be understated by as little as 0.9 to 1.2 percentage points instead of the 1.9 percentage points suggested by the use of factory-gate prices.[15]

The second conclusion comes from the robust finding of lower net TFP growth in the second subperiod is natural. The slowdown reflected the fact that a part of the TFP growth unleashed by the 1978 reforms was a one-time recovery in efficiency from the decade-long Cultural Revolution and from the over-regulation of the economy be central-planning. The agricultural reforms may have accounted for a large part of the initial high net TFP growth.

The third conclusion is that when illegal immigration is taken into account, the reallocation of labor from agriculture accounted for 37 to 54 percent of TFP growth in the whole period, and 45 to 100 percent of TFP growth in the second subperiod. To appreciate how large this effect is, I note that labor reallocation from the farm sector accounted for only 13 percent of TFP growth in the United States in the 1948-69 period.[16] The large labor allocation effect in China reflects the existence of large amount of labor employed in low-productivity agriculture and the success of the post-1978 Chinese reforms in creating higher-productivity jobs in the industry and service sectors.

To summarize the range of estimates, the official growth rates could be reasonably decomposed to:

| (in percentage points per annum) | 1979-93 | 1985-1993 |
|---|---|---|
| official growth rate | 9.3 | 9.7 |
| inconsistent use of base years | 0.2 | 0.3 |
| overstatement of industrial output | 0.5 to 0.7 | 0.9 to 1.2 |
| capital accumulation | 4.9 | 5.5 |
| labor force growth | 1.3 | 1.1 |
| reallocation of labor from agriculture | 1.1 | 1.3 |
| net TFP growth | 1.1 to 1.3 | 0.3 to 0.6 |

[15] Net TFP growth would thus range from -0.3 to 1.2 percentage points in the 1985-93 period.

[16] Denison (1974, pp.127) reported that U.S. national income grew 3.85 percent annually in the 1948-69 period, TFP growth was 1.75 percent, and labor reallocation from the farm sector added 0.23 percentage points to overall growth.

I must emphasize that the above point estimates of TFP growth, labor allocation effect and net TFP growth should be considered together with the range of estimates in Table 5. It is therefore re-assuring that two recent examinations of China's growth performance have arrived at estimates almost similar to those above. For the 1979-90 period, Borensztein and Ostry (1996) have calculated the labor reallocation effect to be about 1.0 percentage point and the plausible range of TFP growth to be -1.0 to 3.8 percent. World Bank (1996) decomposed the 10.2 percent GDP growth of the 1985-94 period into 6.6 percentage points from factor accumulation, 1.1 percentage points from labor reallocation effect and 2.5 percentage points from net TFP growth.[17] While the World Bank study did not address the issue about the overstatement of industrial output caused by underdeflation when it presented the preceding figures in its main report, it acknowledged this problem (by citing the October 1995 draft of this paper) in a technical annex and noted that its "correction lowers overall efficiency growth by about 1%".[18]

Hu and Khan (1996) decomposed the growth of Chinese-defined National Income (which is close to Net Material Product, the output concept of command economies) and found annual TFP growth to be 3.9 percent during 1979-94. This high TFP growth was generated by ignoring the issue of underdeflation of nominal output and by using a new capital stock series that they constructed. The Hu and Khan capital stock grew 7 percent annually compared to the over 10 percent annual growth in the capital stock constructed by Li (1992) and Nehru and Dhareshawar (1993).[19]

I now turn for a closer look at the agricultural, industrial and foreign sectors to see if they support our future TFP scenario.

## 4. THE SECTORAL GROWTH SITUATION

### The Agriculture Sector

Economic growth came with a rush to the countryside after 1978 with the dismantling of the commune system, the raising of the purchase prices for grain, and the legalization of free markets for many agriculture products. Rural income jumped 17.6 percent in 1979, and income growth stayed at the two-digit level until 1985, see Table 6. The dynamic growth of rural income ended in 1985 when income grew only 4 percent. The average annual rural income growth rate was 2.6 percent in the 1985-94 period compared to the average growth rate of 15 percent in the 1979-84 period.

The course of rural income growth is largely the result of the sharp rise in grain yield in the 1979-84 period and the stagnation in grain yield from 1985 onward, see Table 7. The evidence suggests that yield growth was artificially suppressed in the pre-1978 period by the chaos of the Cultural Revolution that lasted from 1966 to 1977. When economic liberalization of the agriculture sector occurred at the end of 1978, there was a one-time gain in production efficiency, raising the growth in grain yield to 5.7 percent from the 3.1 percent of the preceding twelve years. The drop in grain yield after 1984 was across the board; rice yield

[17] I have converted the terminology of Table A in World Bank (1996, Volume I, pp. 12) into the terminology used in this paper, e.g. its definition of TFP growth deviated from the standard usage of Denison (1969) by listing reallocation of agricultural labor as distinct from TFP growth.

[18] Footnote 7 in Annex 4 of Volume 2 (pp. 32) of World Bank (1996).

[19] This study and Borensteinsztein and Ostry (1996) are based on Li's (1992) capital stock data, and World Bank (1996) is based on Nehru and Dhareshawar's (1993) capital stock data; with updating in all cases for recent years

growth dropped from 5.1 percent to 1.3 percent from 1985 onward, and wheat yield growth dropped from 8 percent to 2 percent.

The troubling aspect is that yield growth in the 1985-94 period is lower than in the 1966-77 period. One reason why yield growth is lower now may lie in the reduced amount of rural infrastructure investment since 1979. Real public capital construction is lower in 1994 than in 1978, and this has been true for every year since 1980, see Table 6.

The Industrial Sector

The single consensus from the many studies on TFP growth in the industrial sector is that TFP growth in the industrial COEs was positive and greatly exceeded that in the industrial SOEs; e.g. Huang and Meng (1995), Jefferson, Rawski and Zheng (1992), and Woo, Hai, Jin and Fan (1994) who will be designated HM, JRZ and WHJF respectively.[20] For example, JRZ estimated the annual TFP growth rate in the 1980-88 period to be 2.4 percent for SOEs and 4.6 percent for COEs.

The issue under contention is whether the SOEs has had positive TFP growth. Using survey samples, HM and WHJF found the TFP growth rate for SOEs to be, respectively, -4.7 percent in the 1986-90 period, and zero in the 1985-88 period. When WHJF deflated their intermediate inputs in the same way as JRZ, they found the same result as JRZ, 2.4 percent for TFP growth. However, WHJF found that the JRZ deflation method caused the implicit deflator for the value-added (VAD, value-added deflator) of SOEs in their sample to decline secularly throughout the sample period when CPI was rising steadily. Upon examination, the VAD in JRZ and those in Groves, Hong, McMillan and Naughton (GHMN, 1994 and 1995), two studies that also found large positive TFP growth in the 1980-89 period, also declined secularly over their sample periods.[21] Such opposite trends between the CPI and the VAD created by JRZ's and GHMN's deflation methods is troubling because such occurrences are internationally unprecedented.

Naughton (1994) and JRZ (1994) have argued that a declining VAD is to be expected when input prices rise more than output prices. However, their arguement is not correct because a relative rise in input prices is only a necessary condition but not a sufficient one. The condition for a secularly declining VAD is given by:

$$[(P_t^G - P_0^G)/P_0^G] > [1+(a_t - a_0)/a_0]*[P_0^I M_0/P_0^G Q_0]*[(P_t^I - P_0^I)/P_0^I]$$

where

$M_i$ = intermediate inputs in period i in physical units;
$Q_i$ = gross output in period i in physical units;
$P_i^G$ = price of gross output in period i;
$P_i^I$ = price of intermediate input in period i;
$a_i$ = $M_i/Q_i$, the input-output coefficient in period i.[22]

[20] However, given the evidence in the preceding sections that COE output is likely to have been overstated, even this conclusion is tentative.

[21] The declining VAD in GHMN cannot be discerned in the two articles themselves, this facet was revealed in Naughton (1994) for GHMN (1995). I assume it to be also true for GHMN (1994) because it uses the same deflation techniques and sample as GHMN (1995).

[22] The legacy of central planning is that at the beginning of industrial reform, prices of intermediate inputs to industry were artificially suppressed and prices of industrial goods artificially raised in order to concentrate revenue in the industrial sector to make revenue collection convenient for the state. So we expect ($P_0^I M_0/P_t^I M_t$) to be much smaller than unity. As the prices of intermediate inputs have risen relative to output prices, the economizing by enterprises on the use

We should note that the quadrupling and doubling of oil prices in 1973 and 1978 respectively did not cause any country's GDP deflator to decline. A declining VAD is also unlikely to be the product of gradual reforms because neither Polish nor Hungarian industrial VAD declined for sustained periods during their pre-1989 gradual reforms. WHJF attributed JRZ's and GHMN's declining VADs to their output price deflators being under-stated and their intermediate input price deflators being over-stated.

In a recent article, JRZ (1996) defended their deflators for gross output and intermediate inputs, and attributed the declining VAD to the *unusual production structure* of China's manufacturing sector: China's manufacturing sector had an usually low gross value added (GVA) to gross output value (GVO) ratio, i.e.

$$(P_t^I M_t / P_t^G Q_t)_{China} > (P_t^I M_t / P_t^G Q_t)_{USA}$$

They computed the (GVA/GOV) ratio to be 46% for the United States, 40% for Japan, 45% for West Germany and 44% for the United Kingdom compared to the (GVA/GOV) ratio for China which was 33% in 1980, 31% in 1984, 29% in 1988, and 25% in 1992.

However, JRZ's finding of an unusual Chinese industrial structure for China appears to be a fragile one. Specifically, JRZ's proposition which is based on Industrial Yearbook data does not hold when the 1987 Input-Output Table data are used instead. The Industrial Yearbook data are based on the financial reports (similar to information given to the industrial census) filed by the enterprises, while the Input-Output Table data adjusted the industrial census data to be compatible with economy-wide input-output flows. Ren Ruoen (private communications) rendered the GVA data from China's Input-Output Table to be consistent with the US Industrial Census definition of GVA by adding in payments to intermediate services[23] The results of Ren Ruoen's calculations is that the ratio of gross value added to gross output value for the industrial sector was and 42% for China when Input-Output Table data were used. Our calculations, using US Commerce Department data, found the ratio to be 44 percent for the USA. Each of China's industrial sectoral (GVA/GOV) from the Input-Output Table was not only larger than the (GVA/GOV) from the Industrial Yearbook, but also closer to the US sectoral (GVA/GOV).

Finally, JRZ's finding of low and secularly declining (GVA/GOV) ratio for China suggest to us under-measurement of GVA caused by the growing appropriation of capital income by SOE personnel. Fan and Woo (1996) have shown that one unintended result of granting increasing operational autonomy to the SOE managers is that they have over time learned how to use various accounting subterfuges to overstate production costs in order transfer enterprise income to themselves and the workers. This is why (GVA/GOV) calculated from the financial information supplied by the enterprises has been declining steadily in the reform period, and why the adjustment of GVA to be compatible with economy-wide flows produced much higher (GVA/GOV). This also explains why China's SOEs have been running greater losses every year, even in years of high growth and in sectors where entry by non-state enterprises has been minimal.

## A One-Time Improvement in Industrial Efficiency

In light of the earlier analysis on grain yield, I suspect that the ending of the economic incoherence generated by the Cultural Revolution caused a one-time catch-up in the efficiency of SOEs during the 1979-84 period. After that initial rebound, the incremental decentralization measures introduced since 1984 have

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of intermediate inputs renders $[1-(a_t-a_0)/a_0]$ less than unity. The net result is that intermediate input prices have to rise significantly more than output prices in order for a declining VAD to occur.

[23] The GVA data reported in the Industrial Yearbook are supposed to already include payments to intermediate services; see Ren (forthcoming).

failed to induce the industrial SOEs to improve their efficiency on a sustained basis.

My hypothesis would reconcile the findings of positive TFP growth in SOEs in the pre-1985 period[24] with the findings of zero TFP growth in the post-1984 period. This hypothesis implies that a study that finds positive TFP growth in industrial SOEs in the post-1978 period would find zero TFP growth after dropping the 1979-84 period from the estimation. This hypothesis is tested in Table 8 using the data on industrial SOEs and industrial TVEs in Wu and Wu (1994).

Part A of Table 8 treats the data as in Wu and Wu (1994), output and capital were deflated using the implicit industry deflator from the GDP accounts. Part A shows that TFP growth rates in SOEs ranged from 0.9 percent to 1.9 percent over the 1979-91 period. However, the SOEs' TFP growth rate went to zero in two of the three cases when the estimation period was restricted to 1985-91. The TFP growth rate in TVEs was significantly positive in the subperiod as well in the entire period, but usually lower in the former. Part A supports the hypothesis that there was a strong one-time productivity gain when decentralization reforms were first introduced.

However, there are two measurement issues with the data used in Part A. First, Wu and Wu's method of constructing the capital stock biases the estimation to produce a positive TFP result. This is because the capital stock of any period was obtained by deflating that period's nominal net fixed assets (which is original book value minus depreciation) of each period by the industrial VAD from the national accounts. This continuous deflation of the remaining capital stock in subsequent periods steadily reduced the measured size of the remaining capital stock, hence boosting up estimates of TFP growth. Second, from the earlier discussion, the industrial VAD from the national accounts understates the actual inflation. This exaggeration of real output growth could mean exaggeration of TFP growth.

Part B of Table 8 re-estimates the TFP growth rates after adjusting Wu and Wu's data. The official depreciation rates were applied to the nominal fixed assets data to derive the nominal investment in each period. After deflating the investment flow with the factory-gate price index, the real capital stock was constructed using the perpetual inventory method under the assumption of a 5 percent depreciation rate. Output was also deflated by the factory-gate price index.

Part B shows that average TFP growth for SOEs was -1.1 percent in the 1979-91 period and -4.4 percent in the 1985-91 subperiod. Average TFP growth for TVEs was 2.0 percent in the 1979-91 period and 0.0 percent in the 1985-91 subperiod.[25] Part B also supports the hypothesis that there was a strong one-time productivity gain when decentralization reforms were first introduced.

I attribute the better performance of the TVEs to them being fundamentally different from SOEs in three important ways. The first difference is that TVEs face less of a principal-agent problem than the SOEs because of shorter supervision distance. The direct linkage in TVEs between local people's working efforts and their economic benefits not only reduces the cost of supervision but also improves the local owners' incentives to monitor the management, and exert pressures on managers to improve the business.

The second difference is that TVEs face hard budget constraints. Being a non-state enterprise means that the rescue of a bankrupt TVE is not the state's responsibility. In the last economic downtown, the number of industrial TVEs fell from 7.7 million in 1988 to 7.2 million in 1990 while the number of industrial SOEs increased from 99 thousand to 104 thousand.

The third difference is that TVEs can implement institutional innovations without the approval of the

[24] Chen, Wang, Zheng, Jefferson and Rawski (1988), Dollar (1990), Granick (1990) and Jefferson (1990).

[25] Zero in the subperiod because all three rates are statistically insignificant.

central government. The most recent locally-initiated institutional development is the transformation of the TVEs into "share-holding co-operatives." The TVEs are equitised and a portion of the shares are given to the original residents. This freedom of TVEs has enabled them to move closer to best international practices in corporate governance.

### The Foreign-Funded and International Trade Sectors

The direct contribution of foreign-funded enterprises (FFE) to GDP growth has been small. As industrial FFEs account for less than 9 percentage points of output growth in 1985-93, their effect on economy-wide TFP is small even if there is significant direct TFP growth in FFE production. FFEs' contribution to economy-wide TFP is increased to the extent that competition with FFEs and emulation of FFEs' management practices by domestic firms increase their efficiency. This externality is likely to be small.

The international trade sector has increased from 10 percent of GNP in 1978 to 36 percent in 1993. This unusually high trade/GDP ratio reflected the tremendous explosion of processing and assembly operations attracted by cheap Chinese labor. The international trade sector has created positive TFP growth by moving labor from low-productivity agriculture to higher-productivity industrial production. Given the large pool of low-cost unskilled rural labor, the positive TFP rate from labor re-allocation is sustainable in the medium run.

The opening up to international trade also allowed comparative advantage to increase allocative efficiency through changes in the composition of output. The increasing direct competition from imports has exerted pressure on domestic producers to improve their operations, and this pressure will grow as President Jiang Zemin's pledge at the 1995 APEC meeting to reduce China's tariffs is implemented.

## 5. EXPLAINING THE GROWTH

The high rate of capital accumulation (the biggest contributor to Chinese growth) has its basis in the liberalization of a labor-surplus economy that has a high saving rate. Investment is highly profitable because the surplus labor prevented the real wage from rising significantly and the large pool of domestic saving prevented the interest rate from rising. The importance of the latter is seen in that household saving is about 23 percent of disposable income in China versus 21 percent in Japan, 18 percent for Taiwan, 16 percent for Belgium, 13 percent for West Germany and 8 percent for the United States (World Bank, 1990, Table 4.9).

Besides the existence of surplus agriculture labor, there were two other initial conditions that helped Chinese economic growth. The first supplementary initial condition was that the extent of China's central planning was much smaller than Russia's and Poland's. Qian and Xu (1993) noted that around 25 million commodities entered the Soviet economic plans, while in China, only around 1,200 commodities were included. The second supplementary condition was that China's reforms, unlike Polish and Russian reforms, did not start in a situation with large macroeconomic imbalances and a severe external debt crisis that required the implementation of an austerity program.

Another key factor behind China's impressive growth is its integration into the global economy. This factor operates through four channels. First, the access to international markets for labor-intensive manufactured goods accelerated the movement of labor out of low-productivity agriculture into high-productivity industry. Second, China could now buy modern technology (some of which were previously denied to China). Third, foreign direct investments increased the capital stock, transferred new technology, made available global distribution networks, and introduced domestic firms to more efficient management techniques. Fourth, the competition from international trade forced Chinese enterprises to be more efficient and innovative.

It should be noted that China's high household saving rate helped stabilize the economy beside enabling to a high rate of capital accummulation. It reduced inflation in the Chinese economy through two channels. First, the flow of savings through the banks reduced the need to print money to meet the excessive resource demand of the SOE sector. Second, as money was (until recently) the only form of financial saving in China, the high saving rate meant an increasing demand for money, hence dampening inflation pressure. This inflation-damping effect can be seen in the rise of the M2 to GNP ratio from 38 percent in 1979 to 106 percent in 1992.

## 5. CHALLENGES AND FUTURE GROWTH SCENARIO

Economic liberalization of China's surplus labor economy is the root cause of China's impressive growth. Economic efficiency improvements have been highest where economic liberalization has been bold (e.g. the decollectivisation of agriculture and the establishment of the COEs), and small when liberalization has been slow (e.g. the SOE sector). It therefore augurs well for China's economic future that the 15th Party Congress in September 1997 has decided to privatize 369,000 of China's 370,000 SOEs.

How compatible is the fixed investment rate of 32 percent of the Ninth Five-Year Plan with the 8 percent growth target?

Before answering this question, we note from the 1985-93 experience that an average investment-GDP ratio of 29 percent produced a capital stock growth rate of 11 percent.[26] Using the formula:

$$(dK/K) = (I/Y)(Y/K) - r$$

where K = capital stock
I = fixed investment
Y = GDP
r = depreciation rate

yields a capital-output ratio of 1.8 when a 5 percent depreciation rate is assumed.

I will assume that during the 9th 5-year plan:
(a) underdeflation of nominal output is corrected,
(b) labor reallocation effect = 1.2 percent
(c) net TFP growth = 0.4 percent
(d) labor force growth = 2.0 percent
(e) (K/Y) = 2.0
(f) $\beta$ = 0.5
(g) r = 5.0 percent

The first result is that:

$$(I/Y) = 32 \text{ percent}$$

will produce

$$(dK/K) = 11 \text{ percent}$$

Then using:

$$(dY/Y) = \text{capital contribution} + \text{labor contribution} + \text{TFP growth}$$
$$= 5.5 + 1.0 + 1.6$$
$$= 8.1 \text{ percent}$$

[26] Investment here refers only to fixed capital formation.

> 8.0 percent target

On the basis of past growth, I would say that the Chinese government would almost surely achieve the 8 percent growth target. In fact, if the commitments of the Ninth Five-Year Plan to deepen reform in the enterprise sector and to increase China's opening to the world are fully implemented, I would venture the prediction that the 32 fixed investment rate would yield an average 9 percent growth rate because of TFP improvements of the magnitudes seen in the 1979-84 period.

In a way, the validity of this paper's analysis of China's growth record is supported by how close our estimated growth rate is to the target growth rate. The closeness suggests that the TFP growth rate assumed by the Chinese government is almost identical to the one I found. This may explain the radical enterprise reform program launched at the 15th Party Congress. The decision to privatise China's SOEs reflects, one, the official awareness that economic growth has been largely extensive in nature with little true technological progress, and, two, the official desire to switch the economy on to a more intensive growth path.

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TABLE 1: GDP GROWTH RATES

(in percent)

| | official | consistently re-based on 1990 prices | industrial output component re-deflated by factory-gate price index |
|---|---|---|---|
| | (1) | (2) | (3) |
| 1978 | 11.70 | 10.92 | |
| 1979 | 7.60 | 7.42 | 7.45 |
| 1980 | 7.81 | 6.90 | 7.25 |
| 1981 | 4.48 | 4.93 | 4.93 |
| 1982 | 8.25 | 8.60 | 8.34 |
| 1983 | 10.44 | 10.46 | 10.50 |
| 1984 | 14.56 | 14.46 | 14.86 |
| 1985 | 12.89 | 11.98 | 10.77 |
| 1986 | 8.48 | 8.22 | 8.80 |
| 1987 | 11.12 | 10.68 | 8.37 |
| 1988 | 11.24 | 10.52 | 8.47 |
| 1989 | 4.34 | 4.13 | -0.16 |
| 1990 | 3.89 | 4.04 | 3.34 |
| 1991 | 8.00 | 8.00 | 6.94 |
| 1992 | 13.60 | 13.60 | 12.37 |
| 1993 | 13.41 | 13.41 | 8.89 |
| average 1979-1993 | 9.34 | 9.16 | 8.07 |
| average 1979-1984 | 8.86 | 8.80 | 8.89 |
| average 1985-1993 | 9.66 | 9.40 | 7.53 |

Series (3) was also consistently based on 1990 prices.

yrate/eit

Table 2: Different Ways of Constructing Real Industrial Output

| | industry component of GDP accounts | total gross industrial output | industrial soe gross output | industrial collective gross output | factory-gate price of industrial output |
|---|---|---|---|---|---|
| Part A: Deflators for industrial output according to above sources: | | | | | |
| - | | | ( 1990 = 100) | | |
| 1978 | 71.45 | 69.00 | 60.85 | 79.76 | 55.99 |
| 1979 | 72.38 | 70.06 | 62.42 | 78.10 | 56.83 |
| 1980 | 72.52 | 70.60 | 63.00 | 78.87 | 57.11 |
| 1981 | 73.15 | 70.92 | 63.35 | 79.27 | 57.22 |
| 1982 | 72.99 | 70.78 | 63.41 | 78.52 | 57.11 |
| 1983 | 73.09 | 70.77 | 63.51 | 78.36 | 57.05 |
| 1984 | 74.70 | 71.76 | 64.75 | 79.07 | 57.85 |
| 1985 | 78.15 | 75.41 | 68.65 | 82.08 | 62.89 |
| 1986 | 81.96 | 77.80 | 71.52 | 83.74 | 65.27 |
| 1987 | 83.69 | 81.57 | 76.05 | 86.61 | 70.43 |
| 1988 | 91.47 | 89.10 | 84.73 | 93.10 | 81.00 |
| 1989 | 97.72 | 99.17 | 97.28 | 100.52 | 96.06 |
| 1990 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| 1991 | 103.65 | 102.88 | 105.39 | 99.94 | 106.20 |
| 1992 | 108.12 | 105.86 | 111.75 | 100.33 | 113.42 |
| 1993 | 122.76 | 117.55 | 134.76 | 105.78 | 140.64 |
| Part B: Rate of change in price index calculated from above sources: | | | | | |
| - | | | | | |
| 1979 | 1.31 | 1.54 | 2.58 | -2.07 | 1.50 |
| 1980 | 0.19 | 0.76 | 0.93 | 0.98 | 0.50 |
| 1981 | 0.87 | 0.45 | 0.56 | 0.51 | 0.20 |
| 1982 | -0.21 | -0.19 | 0.10 | -0.95 | -0.20 |
| 1983 | 0.13 | -0.02 | 0.15 | -0.20 | -0.10 |
| 1984 | 2.20 | 1.40 | 1.95 | 0.91 | 1.40 |
| 1985 | 4.62 | 5.08 | 6.03 | 3.81 | 8.70 |
| 1986 | 4.87 | 3.17 | 4.18 | 2.02 | 3.80 |
| 1987 | 2.12 | 4.85 | 6.33 | 3.42 | 7.90 |
| 1988 | 9.29 | 9.23 | 11.42 | 7.49 | 15.00 |
| 1989 | 6.83 | 11.30 | 14.81 | 7.97 | 18.60 |
| 1990 | 2.33 | 0.84 | 2.80 | -0.51 | 4.10 |
| 1991 | 3.65 | 2.88 | 5.39 | -0.06 | 6.20 |
| 1992 | 4.32 | 2.90 | 6.04 | 0.39 | 6.80 |
| 1993 | 13.54 | 11.04 | 20.58 | 5.43 | 24.00 |

Table 2 (cont)

| | industry component of GDP accounts | total gross industrial output | industrial soe gross output | industrial collective gross output | factory-gate price of industrial output |
|---|---|---|---|---|---|
| Part C: Total real industrial output, value added, after deflation by price index from above source (in 1990 prices) | | | | | |
| 1978 | 224.93 | 232.90 | 264.08 | 201.49 | 287.03 |
| 1979 | 244.49 | 252.59 | 283.51 | 226.59 | 311.42 |
| 1980 | 275.31 | 282.81 | 316.91 | 253.15 | 349.58 |
| 1981 | 280.03 | 288.85 | 323.34 | 258.42 | 357.96 |
| 1982 | 296.23 | 305.48 | 340.98 | 275.39 | 378.62 |
| 1983 | 325.02 | 335.67 | 374.05 | 303.16 | 416.38 |
| 1984 | 373.38 | 388.64 | 430.75 | 352.71 | 482.09 |
| 1985 | 441.31 | 457.33 | 502.35 | 420.15 | 548.41 |
| 1986 | 484.04 | 509.90 | 554.67 | 473.74 | 607.74 |
| 1987 | 547.92 | 562.20 | 603.02 | 529.50 | 651.10 |
| 1988 | 631.59 | 648.41 | 681.83 | 620.56 | 713.27 |
| 1989 | 663.53 | 653.83 | 666.54 | 645.06 | 674.98 |
| 1990 | 685.80 | 685.80 | 685.80 | 685.80 | 685.80 |
| 1991 | 780.27 | 786.09 | 767.35 | 809.20 | 761.50 |
| 1992 | 951.21 | 971.53 | 920.28 | 1025.05 | 906.75 |
| 1993 | 1151.85 | 1202.90 | 1049.29 | 1336.73 | 1005.38 |
| Part D: Growth rates of industrial value added (in percent) | | | | | |
| 1979 | 8.70 | 8.45 | 7.36 | 12.46 | 8.50 |
| 1980 | 12.60 | 11.96 | 11.78 | 11.72 | 12.25 |
| 1981 | 1.72 | 2.14 | 2.03 | 2.08 | 2.39 |
| 1982 | 5.78 | 5.76 | 5.46 | 6.57 | 5.77 |
| 1983 | 9.72 | 9.88 | 9.70 | 10.08 | 9.97 |
| 1984 | 14.88 | 15.78 | 15.16 | 16.35 | 15.78 |
| 1985 | 18.19 | 17.67 | 16.62 | 19.12 | 13.76 |
| 1986 | 9.68 | 11.50 | 10.42 | 12.75 | 10.82 |
| 1987 | 13.20 | 10.26 | 8.72 | 11.77 | 7.14 |
| 1988 | 15.27 | 15.34 | 13.07 | 17.20 | 9.55 |
| 1989 | 5.06 | 0.84 | -2.24 | 3.95 | -5.37 |
| 1990 | 3.36 | 4.89 | 2.89 | 6.32 | 1.60 |
| 1991 | 13.78 | 14.62 | 11.89 | 17.99 | 11.04 |
| 1992 | 21.91 | 23.59 | 19.93 | 26.67 | 19.07 |
| 1993 | 21.09 | 23.81 | 14.02 | 30.41 | 10.88 |

indrev/eit

TABLE 3: SHARE OF CONTRIBUTION TO GDP GROWTH RATE BY SECTOR
(and by ownership in the industry sector)

(in percentage points, each row sums to 100)

section 1: using official data, with series consistently re-based on 1990 prices

| sectoral contribution | primary sector | industrial sector | | | | constru -ction sector | tertiary sector |
|---|---|---|---|---|---|---|---|
| | | state-owned (soe) | collective -owned (coe) | individual -owned | other forms | | |
| growth in 79-93 | 16.51 | 13.79 | 25.02 | 5.91 | 6.93 | 5.70 | 26.14 |
| growth in 79-84 | 31.77 | 20.32 | 12.82 | 0.17 | 0.77 | 5.22 | 28.93 |
| growth in 85-93 | 11.62 | 11.70 | 28.93 | 7.74 | 8.91 | 5.85 | 25.25 |

section 2: after re-deflating industrial output by factory-gate price index

| sectoral contribution | primary sector | industrial sector | | | | constru -ction sector | tertiary sector |
|---|---|---|---|---|---|---|---|
| | | state-owned (soe) | collective -owned (coe) | individual -owned | other forms | | |
| growth in 79-93 | 18.79 | 12.90 | 20.28 | 5.36 | 6.44 | 6.49 | 29.75 |
| growth in 79-84 | 29.25 | 21.84 | 16.24 | 0.20 | 1.02 | 4.80 | 26.64 |
| growth in 85-93 | 14.30 | 9.08 | 22.00 | 7.56 | 8.76 | 7.21 | 31.08 |

contri3/contri1/contri2/eit

TABLE 4: CONTRIBUTIONS OF CAPITAL ACCUMMULATION, LABOR FORCE GROWTH AND TOTAL FACTOR PRODUCTIVITY (TFP) GROWTH TO GDP GROWTH RATE

(a) Compound growth rate of GDP, using official 1978-93 data that have been consistently re-based on 1990 prices (in percent)

| | |
|---|---|
| average 1979-93 | 9.11 |
| average 1979-84 | 8.75 |
| average 1985-93 | 9.34 |

(b) Compound growth rate of GDP, which has its industrial value added re-deflated by the factory gate price index; also consistently re-based on 1990 prices (in percent)

| | |
|---|---|
| average 1979-93 | 8.02 |
| average 1979-84 | 8.84 |
| average 1985-93 | 7.47 |

| | compound growth rate (percent) | contributions to growth rate | | |
|---|---|---|---|---|
| | | beta = 0.40 | 0.50 | 0.60 |
| | | (percentage points) | | |
| (c) contribution of capital accummulation to GDP growth | | | | |
| average 1979-93 | 9.79 | 5.88 | 4.90 | 3.92 |
| average 1979-84 | 8.08 | 4.85 | 4.04 | 3.23 |
| average 1985-93 | 10.96 | 6.58 | 5.48 | 4.38 |
| (d) contribution of labor force expansion to GDP growth | | | | |
| average 1979-93 | 2.73 | 1.10 | 1.37 | 1.64 |
| average 1979-84 | 3.09 | 1.24 | 1.55 | 1.85 |
| average 1985-93 | 2.51 | 1.00 | 1.25 | 1.50 |
| (e) contribution of TFP growth to GDP growth (with official industrial value added data) | | | | |
| average 1979-93 | | 2.14 | 2.84 | 3.55 |
| average 1979-84 | | 2.67 | 3.17 | 3.67 |
| average 1985-93 | | 1.77 | 2.61 | 3.46 |
| (f) contribution of TFP growth to GDP growth (with industrial value added re-deflated by factory-gate price index) | | | | |
| average 1979-93 | | 1.05 | 1.75 | 2.46 |
| average 1979-84 | | 2.76 | 3.26 | 3.76 |
| average 1985-93 | | -0.11 | 0.74 | 1.58 |

"beta" = the exponent of labor in the Cobb-Douglas production function.
Compound growth rate for 1979-93 is calculated using 1978 and 1993 levels.

tfprevc/tfprevb/eit

TABLE 5: DECOMPOSING TOTAL FACTOR PRODUCTIVITY (TFP) GROWTH INTO LABOR REALLOCATION EFFECT AND NET TFP GROWTH

| | TFP growth rate from using official industrial value added data | | | TFP growth rate from using industrial value added re-deflated by factory-gate price index | | |
|---|---|---|---|---|---|---|
| beta = | 0.40 | 0.50 | 0.60 | 0.40 | 0.50 | 0.60 |
| Section A: Decomposing TFP growth rate without considering illegal migration | | | | | | |
| | | | Labor Reallocation Effect (in percentage points) | | | |
| avg 79-93 | 0.48 | 0.61 | 0.73 | 0.50 | 0.62 | 0.74 |
| avg 79-84 | 0.57 | 0.71 | 0.85 | 0.60 | 0.75 | 0.90 |
| avg 85-93 | 0.38 | 0.48 | 0.57 | 0.39 | 0.49 | 0.59 |
| | | | Net TFP Growth (in percentage points) | | | |
| avg 79-93 | 1.65 | 2.24 | 2.82 | 0.55 | 1.13 | 1.71 |
| avg 79-84 | 2.10 | 2.46 | 2.82 | 2.16 | 2.51 | 2.86 |
| avg 85-93 | 1.38 | 2.13 | 2.88 | -0.50 | 0.25 | 1.00 |
| Section B: Decomposing TFP growth rate assuming illegal migration to be 100 million from 1984 to 1993 | | | | | | |
| | | | Labor Reallocation Effect (in percentage points) | | | |
| avg 79-93 | 0.85 | 1.06 | 1.28 | 0.88 | 1.10 | 1.32 |
| avg 79-84 | 0.57 | 0.71 | 0.85 | 0.60 | 0.75 | 0.90 |
| avg 85-93 | 1.04 | 1.30 | 1.56 | 1.08 | 1.35 | 1.62 |
| | | | Net TFP Growth (in percentage points) | | | |
| avg 79-93 | 1.29 | 1.78 | 2.27 | 0.16 | 0.65 | 1.13 |
| avg 79-84 | 2.10 | 2.46 | 2.82 | 2.16 | 2.51 | 2.86 |
| avg 85-93 | 0.72 | 1.31 | 1.89 | -1.19 | -0.62 | -0.04 |

"beta = exponent of labor variable in Cobb-Douglas production function.
Average output share during the period was used in the calculations.

tfprevd/tfpreva/tfprev/eit

TABLE 6:

RURAL INCOME, GRAIN YIELD, STATE CAPITAL INVESTMENTS IN AGRICULTURE, AND URBAN-RURAL INCOME RATIO

| | growth rate of rural per capita real income (percent) | growth rate of yield (percent) | | government expenditure for capital construction in agriculture sector (in 1978 prices) | urban-rural income ratio |
|---|---|---|---|---|---|
| | | grain | rice | | |
| 1978 | na | na | na | 5114 | na |
| 1979 | 17.56 | 11.83 | 6.79 | 6149 | na |
| 1980 | 14.42 | -3.17 | -2.47 | 4763 | na |
| 1981 | 14.38 | 3.28 | 4.35 | 2363 | 2.17 |
| 1982 | 18.87 | 10.58 | 13.19 | 2824 | 1.91 |
| 1983 | 13.32 | 8.61 | 4.29 | 3361 | 1.77 |
| 1984 | 11.37 | 6.17 | 5.29 | 3255 | 1.78 |
| 1985 | 3.99 | -3.73 | -2.23 | 3359 | 1.74 |
| 1986 | 0.45 | 1.29 | 1.71 | 3763 | 1.97 |
| 1987 | 2.78 | 2.55 | 1.40 | 3721 | 1.96 |
| 1988 | 0.27 | -0.83 | -2.49 | 2742 | 1.90 |
| 1989 | -7.48 | 1.26 | 4.26 | 2951 | 2.06 |
| 1990 | 9.50 | 8.28 | 3.95 | 3735 | 2.04 |
| 1991 | 0.63 | -1.45 | -1.50 | 3980 | 2.17 |
| 1992 | 5.68 | 3.31 | 2.89 | 4196 | 2.24 |
| 1993 | 3.39 | 3.17 | 0.88 | 3782 | 2.37 |
| 1994 | 7.36 | -1.64 | -0.39 | 3564 | 2.40 |

Real rural and urban income obtained by using real and urban CPI respectively. Real capital construction obtained by industrial products producer price index

urbanrural/imfsep95

TABLE 7: RICE, WHEAT AND GRAIN YIELD

TREND GROWTH RATE OF GRAIN YIELD (percent)

| Period | Grain | Rice | Wheat |
|---|---|---|---|
| 1966-1977 | 3.05 | 1.41 | 4.39 |
| 1978-1984 | 5.71 | 5.13 | 7.96 |
| 1985-1994 | 2.01 | 1.31 | 1.90 |

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Table 8: Total Factor Productivity of Industrial SOEs and Industrial COEs: Was there a one-time gain in efficiency at the start of reforms?

Numbers without brackets are TFP growth expressed in percent per annum.
Numbers within brackets are absolute values of the t-statistics.

| | beta=0.4 | beta=0.5 | beta=0.6 |
|---|---|---|---|
| **Part A: Wu and Wu (1994) data** | | | |
| State-Owned Enterprises | | | |
| 1978-91 | 0.85 | 1.40 | 1.88 |
| | (3.44) | (5.93) | (8.26) |
| 1984-91 | -0.23 | 0.45 | 1.04 |
| | (0.46) | (0.96) | (2.35) |
| Rural Enterprises (township-village-private owned) | | | |
| 1978-91 | 3.45 | 4.24 | 5.02 |
| | (10.09) | (13.77) | (16.88) |
| 1984-91 | 2.64 | 4.06 | 5.47 |
| | (2.80) | (4.44) | (6.19) |
| **Part B: Used alternative Measures of Capital Stock and Output.** | | | |
| State-Owned Enterprises | | | |
| 1978-91 | -1.77 | -1.13 | -0.48 |
| | (3.33) | (2.21) | (0.99) |
| 1984-91 | -5.19 | -4.41 | -3.64 |
| | (9.98) | (8.30) | (6.68) |
| Rural Enterprises (township-village-private owned) | | | |
| 1978-91 | 1.16 | 1.99 | 2.81 |
| | (1.99) | (3.8) | (6.00) |
| 1984-91 | -1.77 | 1.99 | 1.08 |
| | (1.38) | (0.28) | (0.89) |

"beta" = exponent of labor variable in Cobb-Douglas production function.
Wu and Wu used implicit deflator of industrial value added from the official GDP data to deflate output and capital stock.
In Part B: I derived investment flow from net fixed assets data and used the perpetual inventory method to construct capital stock assuming a 5-percent depreciation rate. Factory-gate price index was used to deflate investment flow and output.

wuwu6/wuwu4/wuwu2, wuwu3, wuwu5/eit