



Discussion Paper Series

No.176

**The Chinese GDP Growth Rate Puzzle:
How Fast Has the Chinese Economy Grown?**

Harry X. Wu

July 2006

**Hitotsubashi University Research Unit
for Statistical Analysis in Social Sciences**

A 21st-Century COE Program

Institute of Economic Research
Hitotsubashi University
Kunitachi, Tokyo, 186-8603 Japan
<http://hi-stat.ier.hit-u.ac.jp/>

THE CHINESE GDP GROWTH RATE PUZZLE: HOW FAST HAS THE CHINESE ECONOMY GROWN?*

Harry X. Wu
The Hong Kong Polytechnic University

Revised in July 2006

ABSTRACT

The Chinese statistical authorities have recently adjusted the Chinese GDP level and growth rate for the period 1993-2004 following China's first national economic census. However, their methodology used in the adjustment is opaque. Using a trend-deviation interpolation approach, this study has managed to replicate the basic procedures of the adjustment and reproduced the official estimates. Through this exercise, it has found that the estimates that could be obtained by the normal interpolation procedures were significantly and arbitrarily modified to satisfy certain needs. Based on some political economy argument, we attempt to explain why the adjustment had to leave the growth rate of 1998 intact and why it had to bypass the price issue and directly work on the real growth rate adjustment. Based on previous studies and other observations, we also challenge the census results on non-service industries.

* The earlier version of this paper is presented at the Asian Economic Panel Meeting held at the Korea Institute of International Economic Policy, March 20-21, 2006, Seoul. Helpful comments and suggestions by Bart van Ark, Ren Ruoan, Huang Yiping, Kim Si Joong and Wing Thye Woo, as well as the participants of the meeting are grateful acknowledged. Correspondence could be sent to the author via email: afhxwu@inet.polyu.edu.hk.

1. INTRODUCTION

The long debate about the problem with China's GDP statistics is in essence not a question of accuracy – indeed there is no such thing as perfect national accounts in any country that could produce faultless GDP figures, but a question of how institutional or methodological problems may cause data fabrication or distortion and, more importantly, how institutional constraints may affect the improvement of statistical methodology (Wu, 2000 and 2002; Maddison, 1998; Ren, 1997; Woo, 1996; Keidel, 1992). These data problems are not only seen in regular statistics (i.e. data collected through China's regular statistical reporting system that was developed during the central planning period) but also in surveys and censuses. Without a doubt, allocating more public resources to conduct surveys or censuses may improve statistical coverage, hence increase the accuracy of statistics, but it alone will not be the solution to the data problems. On December 31, 2004, China conducted its first National Economic Census that covered all nonagricultural (secondary and tertiary) activities, which totally mobilized 13 million personnel with an input of nearly two billion yuan (*People's Daily Online*, December 22, 2005). Yet, the newly released GDP estimates are not less questionable than what we had before.

On December 20, 2005, after about one year's work on the census data, China's National Bureau of Statistics (NBS) announced that the census-based GDP estimate for 2004 was 15,988 billion RMB. This raises the nominal GDP level in 2004 by 2,300 billion RMB or 16.8% compared with the original figures based on the regular statistics (13,688 billion) (Table 1). Of this upward adjustment, 92.6 percent is attributed to, which appears to support NBS's long concern about the under-coverage problem in the accounting of value added by services (see Xu, 2002; Yue and Zhang, 2005), and 10.4 to industry (by the Chinese standard of industrial classification, including mining, manufacturing and utilities, i.e. II (M) in Table 1), which seems surprisingly small given the problems found in the Chinese industrial statistics (to be discussed). There is also a 0.8 percent upward adjustment that is attributed to agriculture, which does not seem to fit into this nonagricultural activity-focused census. However, the above adjustments have resulted in a positive 3.8 percent discrepancy (i.e. $92.6\%+10.4\%+0.8\%=103.8\%$), or 88 billion yuan, that has to be

“made up” by an unexpected downward adjustment for construction output (Panel E, II (C), Table 1).

On January 9, 2006, NBS released its annual adjustment to China’s nominal GDP level and real growth rate for the period 1993-2004. The pre-1993 period was not included in this adjustment because it was previously revised after China’s first tertiary census for 1992. Table 1 calculates the effect of the census-based adjustment on China’s nominal GDP by major sector by comparing the adjusted output data with the original statistics. The adjustment to the value of output in 1992-2004 has raised the nominal growth rate from 13.9 to 17.8 per annum for services (III), from 16.3 to 16.6 for industry (II (M)) and from 11.2 to 11.3 for agriculture (I). As for construction (II (C)), it has been lowered from 17.3 to 16.3 percent per annum. As a result, the nominal GDP growth rate has been adjusted from 14.6 to 16.1 percent per annum.

In Table 2, we further compare the adjusted real GDP growth rates and their implicit deflators with the original statistics. It appears that NBS has attributed the entire upward real output adjustment to services, which raises the real growth rate of the service output from 8.6 to 10 percent per annum. As a result, China’s real GDP growth rate has been raised from 9.4 to 9.9 percent per annum. Taking into account the nominal adjustment as reported in Table 1, the adjustment to the real GDP growth implies that the inflation rate over this period has been raised from 4.8 to 5.7 percent per annum.

However, NBS does not explain why the 7.4-percent nominal adjustment that is attributed to non-service sectors should be treated as a pure price effect. Strikingly, the real GDP growth rate for 1998 remained unadjusted at 7.8%, reflecting the much disputed growth performance of the Chinese economy at the height of the Asian financial crisis. Figure 1 depicts the impact of the adjustment on the real growth performance of China’s service output and total GDP.

TABLE 1: CHINA'S NOMINAL GDP LEVEL AND GROWTH RATE:
ADJUSTED VERSUS ORIGINAL ESTIMATES, 1992-2004

	Total	I	II (M)	II (C)	III	Total	I	II (M)	II (C)	III
	(a) Adjusted Level (billion yuan)					(d) Adjusted Growth Rate (%)				
1992	2,664	580	1,028	142	914	23.2	9.7	27.2	39.4	26.5
1993	3,533	689	1,419	227	1,199	32.6	18.7	38.0	60.1	31.2
1994	4,820	947	1,948	297	1,628	36.4	37.5	37.3	30.8	35.8
1995	6,079	1,202	2,495	373	2,009	26.1	26.9	28.1	25.8	23.4
1996	7,118	1,389	2,945	439	2,346	17.1	15.5	18.0	17.6	16.7
1997	7,897	1,427	3,292	462	2,717	11.0	2.7	11.8	5.4	15.8
1998	8,440	1,462	3,402	499	3,078	6.9	2.5	3.3	7.9	13.3
1999	8,968	1,455	3,586	517	3,410	6.2	-0.5	5.4	3.7	10.8
2000	9,922	1,472	4,003	552	3,894	10.6	1.2	11.6	6.8	14.2
2001	10,966	1,552	4,358	593	4,463	10.5	5.4	8.9	7.4	14.6
2002	12,033	1,624	4,743	647	5,020	9.7	4.7	8.8	9.0	12.5
2003	13,582	1,707	5,495	749	5,632	12.9	5.1	15.8	15.9	12.2
2004	15,988	2,096	6,521	869	6,502	17.7	22.8	18.7	16.1	15.4
Average						16.1	11.3	16.6	16.3	17.8
	(b) Original Level (billion yuan)					(e) Original Growth Rate (%)				
1992	2,664	580	1,028	142	914	23.2	9.7	27.2	39.4	26.5
1993	3,463	688	1,414	229	1,132	30.0	18.7	37.5	61.5	23.9
1994	4,676	946	1,936	301	1,493	35.0	37.4	36.9	31.9	31.8
1995	5,848	1,199	2,472	382	1,795	25.1	26.8	27.7	26.8	20.2
1996	6,789	1,384	2,908	453	2,043	16.1	15.4	17.7	18.6	13.8
1997	7,446	1,421	3,241	481	2,303	9.7	2.7	11.4	6.2	12.7
1998	7,835	1,455	3,339	523	2,517	5.2	2.4	3.0	8.7	9.3
1999	8,207	1,447	3,509	547	2,704	4.8	-0.5	5.1	4.6	7.4
2000	8,947	1,463	3,905	589	2,991	9.0	1.1	11.3	7.6	10.6
2001	9,732	1,541	4,238	638	3,315	8.8	5.4	8.5	8.3	10.9
2002	10,517	1,612	4,598	701	3,608	8.1	4.6	8.5	9.9	8.8
2003	11,739	1,693	5,309	818	3,919	11.6	5.0	15.5	16.8	8.6
2004	13,688	2,077	6,282	957	4,372	16.6	22.7	18.3	17.0	11.6
Average						14.6	11.2	16.3	17.3	13.9
	(c) Change of Level (billion yuan) (= a - b)					(f) Change of Growth Rate (%) (= d - e)				
1992	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0
1993	70	1	4	-2	67	2.6	0.1	0.4	-1.3	7.3
1994	144	1	12	-5	135	1.4	0.1	0.4	-1.0	3.9
1995	232	3	23	-9	215	1.1	0.1	0.4	-1.0	3.2
1996	329	4	37	-14	303	1.0	0.1	0.4	-0.9	2.9
1997	451	5	51	-19	414	1.3	0.1	0.3	-0.8	3.1
1998	606	7	63	-25	561	1.7	0.1	0.3	-0.9	4.0
1999	761	8	77	-30	706	1.5	0.1	0.3	-0.9	3.4
2000	975	9	99	-37	904	1.6	0.1	0.4	-0.9	3.6
2001	1,234	10	121	-44	1,147	1.8	0.1	0.3	-0.8	3.7
2002	1,516	12	146	-54	1,412	1.7	0.1	0.3	-0.9	3.7
2003	1,843	14	185	-69	1,713	1.3	0.1	0.4	-0.9	3.6
2004	2,300	19	240	-88	2,130	1.1	0.1	0.4	-0.9	3.9
Average						1.5	0.1	0.4	-0.9	3.8

Sources: The adjusted figures are from NBS website (www.stats.gov.cn). The original figures are available from China Statistical Yearbook (NBS, 2005 and other issues).

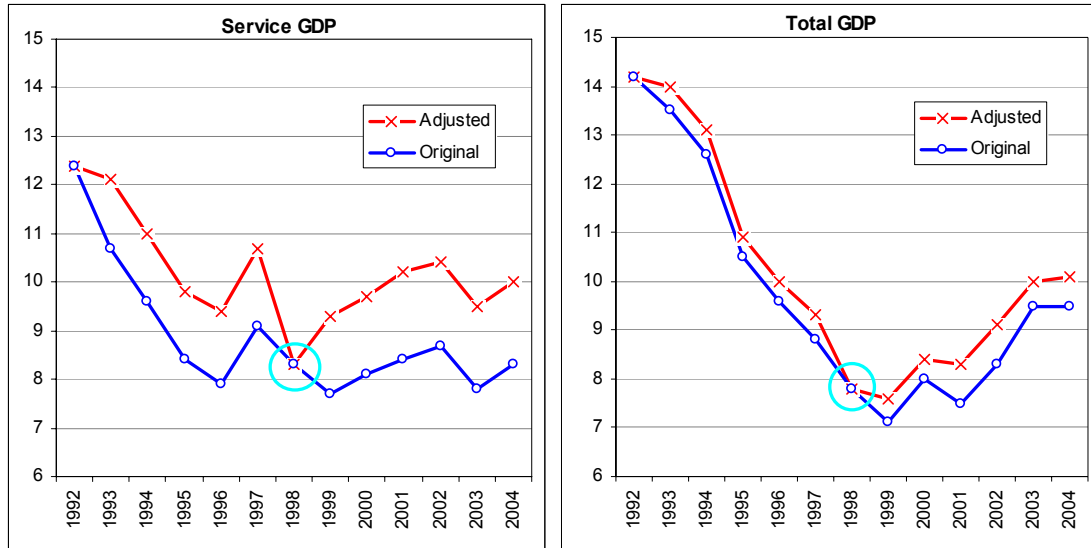
Notes: 1) 1992 is used as the initial benchmark that is not included in the adjustment. 2) I = primary, II = secondary that includes II (M) (manufacturing, mining, utilities) and II (C) (construction), III = tertiary. 3) The implicit GDP deflator is expressed as percent change from the previous year. It is derived by the definition: $P=V/Q$, where P is price index, V is value index and Q is volume index.

TABLE 2: CHINA'S REAL GDP GROWTH RATES AND IMPLICIT GDP DEFLATORS:
ADJUSTED VERSUS ORIGINAL ESTIMATES, 1992-2004

	(a) Adjusted Real Growth Rate (%)					(d) Adjusted Implicit Deflator (%)				
	Total	I	II (M)	II (C)	III	Total	I	II (M)	II (C)	III
1992	14.2	4.7	21.2	21.0	12.4	7.9	4.7	4.9	15.2	12.5
1993	14.0	4.7	20.1	18.0	12.1	16.4	13.4	14.9	35.7	17.1
1994	13.1	4.0	18.9	13.7	11.0	20.6	32.2	15.5	15.1	22.3
1995	10.9	5.0	14.0	12.4	9.8	13.7	20.9	12.3	11.9	12.4
1996	10.0	5.1	12.5	8.5	9.4	6.4	9.9	4.9	8.4	6.7
1997	9.3	3.5	11.3	2.6	10.7	1.5	-0.7	0.4	2.7	4.6
1998	7.8	3.5	8.9	9.0	8.3	-0.9	-1.0	-5.1	-1.0	4.6
1999	7.6	2.8	8.5	4.3	9.3	-1.3	-3.2	-2.8	-0.5	1.3
2000	8.4	2.4	9.8	5.7	9.7	2.1	-1.2	1.7	1.0	4.1
2001	8.3	2.8	8.7	6.8	10.2	2.1	2.6	0.1	0.6	4.0
2002	9.1	2.9	10.0	8.8	10.4	0.6	1.7	-1.1	0.2	1.9
2003	10.0	2.5	12.8	12.1	9.5	2.6	2.5	2.7	3.4	2.5
2004	10.1	6.3	11.5	8.1	10.0	6.9	15.5	6.4	7.4	5.0
Average	9.9	3.8	12.2	9.1	10.0	5.7	7.2	4.0	6.6	7.0
	(b) Original Real Growth Rate (%)					(e) Original Implicit Deflator (%)				
	Total	I	II (M)	II (C)	III	Total	I	II (M)	II (C)	III
1992	14.2	4.7	21.2	21.0	12.4	7.9	4.7	4.9	15.2	12.5
1993	13.5	4.7	20.1	18.0	10.7	14.6	13.3	14.5	36.9	11.9
1994	12.6	4.0	18.9	13.7	9.6	19.9	32.1	15.1	16.0	20.3
1995	10.5	5.0	14.0	12.4	8.4	13.2	20.8	12.0	12.8	10.9
1996	9.6	5.1	12.5	8.5	7.9	5.9	9.8	4.6	9.3	5.5
1997	8.8	3.5	11.3	2.6	9.1	0.8	-0.8	0.1	3.5	3.3
1998	7.8	3.5	8.9	9.0	8.3	-2.4	-1.1	-5.4	-0.2	0.9
1999	7.1	2.8	8.5	4.3	7.7	-2.2	-3.3	-3.1	0.3	-0.3
2000	8.0	2.4	9.8	5.7	8.1	0.9	-1.3	1.4	1.8	2.3
2001	7.5	2.8	8.7	6.8	8.4	1.2	2.5	-0.2	1.4	2.3
2002	8.3	2.9	10.0	8.8	8.7	-0.2	1.6	-1.4	1.0	0.1
2003	9.5	2.5	12.8	12.1	7.8	1.9	2.5	2.4	4.2	0.8
2004	9.5	6.3	11.5	8.1	8.3	6.5	15.4	6.1	8.2	3.0
Average	9.4	3.8	12.2	9.1	8.6	4.8	7.2	3.6	7.5	4.9
	(c) Change of Real Growth Rate (%) (= a - b)					(f) Change of Implicit Deflator (%) (= d - e)				
	Total	I	II (M)	II (C)	III	Total	I	II (M)	II (C)	III
1992	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1993	0.5	0.0	0.0	0.0	1.4	1.8	0.1	0.4	-1.1	5.1
1994	0.5	0.0	0.0	0.0	1.4	0.7	0.1	0.4	-0.9	2.0
1995	0.4	0.0	0.0	0.0	1.4	0.6	0.1	0.4	-0.9	1.5
1996	0.4	0.0	0.0	0.0	1.5	0.5	0.1	0.3	-0.9	1.2
1997	0.5	0.0	0.0	0.0	1.6	0.7	0.1	0.3	-0.8	1.3
1998	0.0	0.0	0.0	0.0	0.0	1.5	0.1	0.3	-0.8	3.7
1999	0.5	0.0	0.0	0.0	1.6	0.9	0.1	0.3	-0.8	1.6
2000	0.4	0.0	0.0	0.0	1.6	1.1	0.1	0.3	-0.8	1.8
2001	0.8	0.0	0.0	0.0	1.8	0.9	0.1	0.3	-0.8	1.7
2002	0.8	0.0	0.0	0.0	1.7	0.8	0.1	0.3	-0.8	1.8
2003	0.5	0.0	0.0	0.0	1.7	0.7	0.1	0.3	-0.8	1.7
2004	0.6	0.0	0.0	0.0	1.7	0.4	0.1	0.3	-0.9	1.9
Average	0.5	0.0	0.0	0.0	1.5	0.9	0.1	0.3	-0.9	2.1

Sources and Notes: See Table 1.

FIGURE 1: GROWTH PERFORMANCE OF CHINA'S REAL GDP:
ADJUSTED VERSUS ORIGINAL ESTIMATES
(Percent per Annum)



Source: Table 1.

In this paper we intend to raise some important questions about NBS's 2004 Census-based GDP adjustment and explore their likely implications for China's real GDP performance. Our first inquiry is about the methodology that was used by NBS in the adjustment. Based on the information about the approach of adjustment released by NBS, we will try to duplicate what NBS did in the adjustment to see whether there was any arbitrary adjustment that might aim to meet certain policy target or to fit into certain policy framework.

Our second inquiry focuses on the underlying price problem. This type of census by nature cannot obtain information on price changes. Even if the 1992 benchmark could be assumed problem-free and thus the under-coverage problem is entirely due to new services and products that emerged after 1992, the Chinese statistical authorities still face complicated price problems. Since the prices of new services and products are usually high at earlier stages and decline quickly throughout the stages of maturing, it is apparently very difficult to make sensible assumptions for price changes in the adjustment. Furthermore, leaving the real GDP growth rate for 1998 completely unadjusted suggests that the output level adjustment for this year is a pure price effect, which appears to be rather incoherent in this what supposed to be systematic adjustment overtime and hence casts serious doubt on the credibility of the

adjustment. Our question about these underlying price problems can be illustrated by Figure 1. Users of the Chinese GDP estimates would naturally expect an explanation about the assumptions that were used for price changes across individual sectors that could warrant the real output adjustment.

Last but not least, it is difficult to accept the findings of the 2004 census that the regular statistics for manufacturing and mining industries are basically free from problems. How could we fit such findings into numerous disclosures of data fabrications in industrial output made by local officials, SOE managers and even private firms with different incentives? In fact, it has been reported that data fabrication to exaggerate local performance could even be more serious in a national event like census than in the regular reporting exercises. Taking into account these possibilities, in the conclusion we would like to propose some conjectures about the likely real GDP performance over this period.

2. THE BASIC APPROACH USED IN THE ADJUSTMENT

To the best of our understanding of the brief explanation in the official announcement (NBS, 2006), the basic approach used by NBS in the 2004 Census-based adjustment of GDP estimates contains three major steps:

Step 1: Deriving a “historical trend” using the GDP estimates for 1992 and 2004 that are based on the *regular statistics* and then calculate the simple deviation of the actual value from the derived trend value for each year.

Step 2: Drawing a “new trend” for the same period using the same GDP estimates for 1992 (as in Step 1) and the 2004 census-based GDP estimates, this generates a new trend value for each year.

Step 3: Interpolating the value for each year between the two benchmarks of the new trend by adjusting the trend value by the deviation obtained in Step 1 based on the historical data.

This approach may be best described as one following the trend-deviation interpolation method often used by national accounts statisticians. Based on what is explained by NBS and the standard procedures of the trend-deviation method,¹ we

¹ See an introduction to the procedures by Derek Blades, the former Chief of National Accounts at OECD, prepared for the NBS/Asian Development Bank Workshop of “Improving Service Statistics” in Shanghai in November 2004.

have managed to repeat the likely procedures used in NBS's recent national accounts adjustment. Our findings show that although NBS in principle adopted the standard procedures in adjusting the nominal GDP according to the new census, they allowed irregularities or arbitrary modifications in the exercise that might be purposely introduced to meet certain growth targets. In what follows, we will firstly present the standard procedures of the trend-deviation method, secondly adjust the nominal GDP using this method, and finally compare our results with the NBS estimates and discuss their implications.

Strictly speaking, the trend-deviation interpolation method requires an indicator (I) that is highly correlated with the variable (X) to be estimated. The indicator is an existing time series, while the variable to be estimated has only two benchmark values based on surveys or censuses. The indicator is used to obtain the deviation of its actual value from its trend value (i.e. trend-deviation ratio) for every time point of the period concerned. By applying the indicator's trend-deviation ratio to the variable to be estimated, it allows the annual movement pattern of the variable to follow that of the indicator.

Firstly, let us assume that both I and X generally follow an exponential trend, then we could estimate their trend growth rates over a given period n , beginning from the time point 0 to the current time T ($T - 0 = n$), for I and X , using the following equations:

$$(1a) \quad r_{trend}^I = \exp\left[\frac{\ln I_T - \ln I_0}{n}\right] - 1$$

and

$$(1b) \quad r_{trend}^X = \exp\left[\frac{\ln X_T - \ln X_0}{n}\right] - 1.$$

Secondly, we could use the estimated growth rate of the trend to calculate the trend value at time t over this period for I and X , respectively:

$$(2a) \quad I_t^{trend} = I_0 (1 + r_{trend}^I)^n$$

and

$$(2b) \quad X_t^{trend} = X_0 (1 + r_{trend}^X)^n.$$

Finally, the X series over the period could be estimated by multiplying the trend value of X by a parameter D based on the indicator I :

$$(3) \quad X_t = D_t^I X_t^{trend}$$

where $D_t^I = I_t^{actual} / I_t^{trend}$, i.e. the deviation of the actual value of the indicator I from its own exponential trend.

In the current China case, the indicator is the historical GDP series that is based on the NBS regular statistics rather than any other non-GDP indicator that is closely associated with the variation of GDP. Precisely, the adjusted GDP series is obtained by adjusting the new (adjusted) GDP trend values based on the 1992 and 2004 censuses by the deviations derived from the historical GDP series (original), that is,

$$(4) \quad GDP_t^{adjusted} = D_t^{original} GDP_t^{trend,adjusted}$$

where $D_t^{original} = GDP_t^{original} / GDP_t^{trend,original}$, the deviation of the actual value from the trend value estimated based on the NBS regular statistics. One of the most obvious merits of this interpolation method is to make use of all available information in the existing statistics and from the newly conducted census.

TABLE 3: NOMINAL GDP ESTIMATES BY EQUATION 4 AND THEIR COMPARISONS WITH THE NBS ADJUSTED ESTIMATES (Billion yuan)

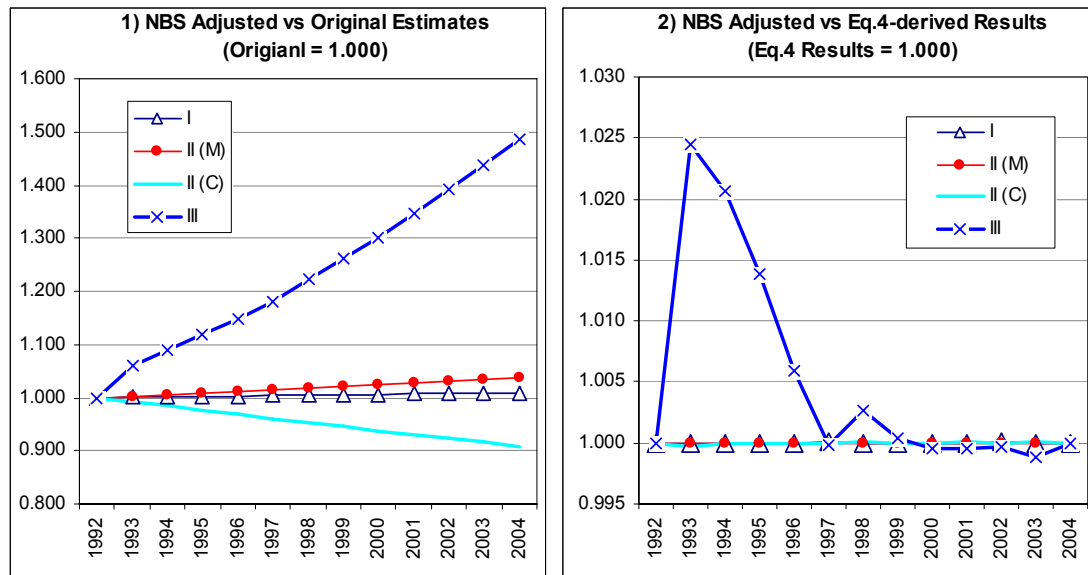
	Results of Interpolation by Eq. (4)					Nominal Gap (=Eq.(4) Estimates – NBS adjusted Estimates)				
	Total	I	II (M)	II (C)	III	Total	I	II (M)	II (C)	III
1992	2,664	580	1,028	142	914	0.0	0.0	0.0	0.0	0.0
1993	3,505	689	1,419	227	1,170	-28.7	0.0	0.0	0.1	-28.7
1994	4,787	947	1,948	297	1,595	-33.0	0.0	0.0	0.0	-33.0
1995	6,052	1,202	2,495	373	1,982	-27.6	0.0	-0.1	0.0	-27.5
1996	7,104	1,389	2,945	439	2,332	-13.9	0.0	0.0	0.0	-13.9
1997	7,898	1,426	3,292	462	2,717	0.4	-0.1	0.0	0.0	0.5
1998	8,432	1,462	3,402	499	3,070	-8.1	0.0	0.1	-0.1	-8.1
1999	8,966	1,455	3,586	517	3,408	-1.4	0.0	0.0	0.0	-1.4
2000	9,923	1,472	4,003	552	3,896	1.9	0.0	-0.1	0.0	2.0
2001	10,967	1,552	4,358	593	4,465	2.0	0.1	0.0	-0.1	1.9
2002	12,035	1,624	4,743	647	5,021	1.6	-0.1	0.0	0.0	1.7
2003	13,589	1,707	5,495	749	5,638	6.3	0.0	0.0	-0.1	6.3
2004	15,988	2,096	6,521	869	6,502	0.0	0.0	0.0	0.0	0.0

Sources: Author's calculation using Equation (4). NBS adjusted nominal GDP data are from Table 1.

We have produced a new set of estimates using Equation (4) and reported it in the left panel of Table 3. In the right panel of the table, we have calculated the nominal

value gap between our results and the NBS adjusted estimates to see if the standard procedures of the trend-deviation interpolation method were followed by NBS. If the standard procedures were strictly followed and no *ad hoc* adjustments were imposed on the results, the expected value of the “nominal gap” should be zero. As shown in Table 3, it appears that on the one hand, NBS did adopt the standard procedures of the trend-deviation interpolation method as expressed in Equation (4) because our Equation (4)-based exercise could produce nearly identical results for all the non-service sectors to those given by NBS, but on the other hand, our results show that NBS indeed introduced some *ad hoc* modifications to what could be obtained by the interpolation as given by Equation (4).

FIGURE 2: HOW MUCH HAS BEEN ADJUSTED AND HOW CLOSE TO THE STANDARD PROCEDURES?
(Nominal GDP indices)



Source: Author’s calculation. Data are from Table 1.

To intuitively demonstrate this point, in Figure 2 we compare the NBS adjusted nominal output with both the NBS original estimates and our Equation (4)-based results. The sector and industry codes are defined as those in Table 1, namely primary (I), secondary (II) and tertiary (III), with the secondary sector further divided into two subgroups, one including manufacturing, mining and utilities and one including construction (II (M) and II (C), respectively). In the first panel, in order to highlight the effect of the NBS adjusted GDP estimates *relative* to the original estimates, the original estimates are set as the base value (=1.000 for all time points). One could see clearly that all sectors are affected by the adjustment, with the tertiary sector affected most and positively, followed by the construction industry, but negatively.

To see whether the adjustment exactly followed the normal procedures, in the second panel, we set the Equation (4)-derived results as the base value (=1). The logic is that if the NBS adjustment strictly followed the normal procedures of the interpolation method, its results would have completely overlapped with our results, i.e. the ratio for all sectors would have been equal to one at all time points. While this is basically true for the non-service sectors, it is not the case for the tertiary sector. One could see that the NBS results for the tertiary sector drift from the baseline at most time points with rather irregular pattern, which confirm that NBS did introduce *ad hoc* adjustments to the results based on Equation (4). Some important questions could be raised from this pattern. Especially, if the 1992 benchmark were indeed problem-free as assumed by NBS, why should the nominal service output in 1993 as obtained by the normal procedures be substantially lifted?

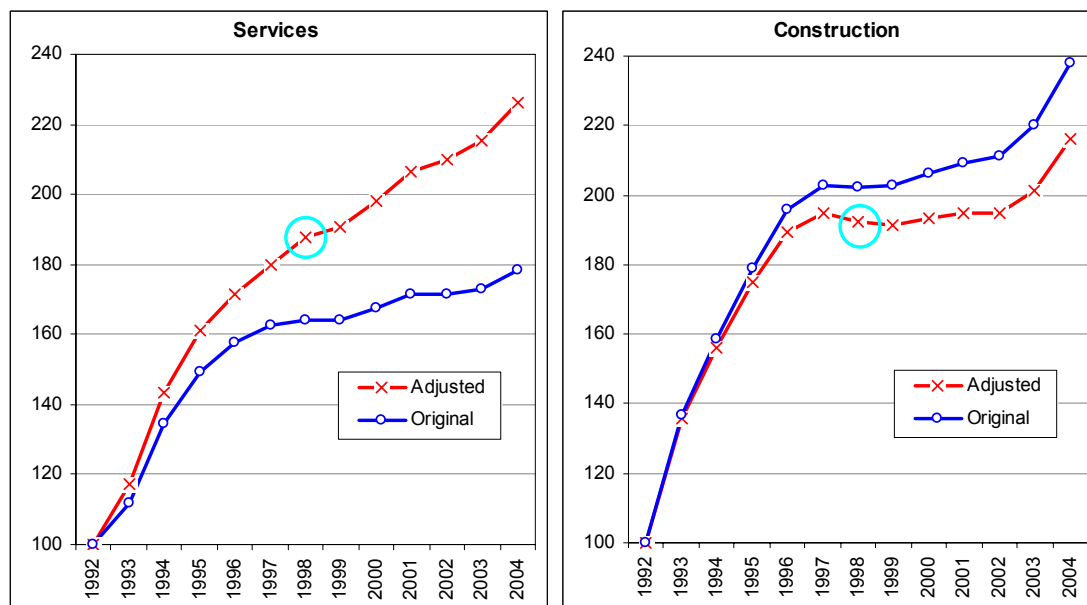
3. HOW WAS THE REAL GDP GROWTH RATE ADJUSTED?

To obtain the estimates for the real GDP growth rates, NBS needs proper deflators. However, China's first economic census in 2004 did not include any survey on prices (which is not a usual task in this type of census). All output and income data collected in the census are stock information at the time of census and in nominal terms. Therefore, in the current problem, the price issue is basically independent. Then, what assumptions were applied to the price changes of individual sectors that could warrant the real GDP adjustment as shown in Figure 1?

Changes in the implicit GDP deflators of individual sectors (Table 2) can be converted into indices based on the 1992 benchmark to demonstrate price changes over time. Figure 3 depicts the implicit price changes of services and construction in this period as suggested by the original data and the adjusted estimates. We choose the two sectors because they were most affected in the adjustment especially in nominal terms and in price deflators. Besides, the adjustment has opposite effect on the two sectors. Intuitively, the price adjustment seems to be fairly systematic. Compared with the original price levels, the adjustment resulted in higher price levels for services and lower price levels for construction over the whole period in question. In general, the underlying trend has changed substantially in both cases, but the annual pattern of the movement remains similar. However, a closer examination shows that in both cases

the (implicit) price adjustment to 1998 created an outlier that was not in line with the original annual pattern and largely responsible for the slop change of the trend.

FIGURE 3: IMPLICIT GDP DEFLATORS FOR THE TERTIARY AND CONSTRUCTION SECTORS:
ADJUSTED VERSUS ORIGINAL ESTIMATES



Source: Tables 1 and 2.

Together with Figure 1 that shows no any adjustment to 1998 in the real GDP growth rate, this observation has taken us back to the hot debate in the early 2000s about the likelihood of the statistical authorities' serious data manipulation to arbitrarily raise the growth rate for 1998 in order to meet then the government (Zhu Rongji Administration)'s growth target when China was badly hit by the Asian financial crisis. The official estimate for the real GDP growth rate in 1998 is 7.8 percent, only 0.2 points lower than the 8 percent growth target, suggesting that the target was only missed by a minuscule margin in a very difficult situation. However, this growth rate has been challenged by many researchers. They believe that it overestimated China's real growth performance in 1998. For example, based on the change of energy consumption for 1997-99, Rawski (2001) suspected that China's real GDP growth in 1998 was at best ranging from -2 to 2 percent. But his estimation was criticized by Ren (2002) among others for lacking sound empirical support. Other researchers used the expenditure approach (in contrast to the NBS's value-added approach), but arrived at very different results. Keidel (2001) found that the growth rate in 1998 could be bounded by 6.9 and 7.2 percent, while Shiau's recent results

showed that it could be somewhere between 2.6 and 4.7 percent (2005). Such variations of estimates are largely due to different choices of deflators. There are also different views. Using the principal component analysis, Klein and Ozmuur (2002) find that the variation of the official GDP growth is well associated with the variation of 15 major macroeconomic indicators, suggesting that the official GDP estimates are not an outlier. Nevertheless, since the major indicators are from the same official sources that generate the information for the GDP estimation, surely no sensible inference can be made from their findings in the context of the debate.

Unfortunately, the infamous “7.8 percent” for 1998 is an important issue that NBS could not easily bypass when adjusting China’s GDP growth rate. Apparently, NBS faced a big dilemma. On the one hand, it could not systematically raise the growth rate of 1998 together with the overall upward adjustment for the whole period because that would invite further international criticism. On the other hand, it could not take this chance to reasonably make a downward adjustment for 1998 because that would indicate that they had admitted the original estimates as a mistake, whose implications would be, however, by no means purely technical. Although leaving 1998 intact in this overall upward adjustment means that the growth rate of 1998 is in fact *relatively* lowered, such an arbitrary treatment has made the whole adjustment less credible.

From the price perspective, the treatment to 1998 also suggests that there were some *ad hoc* modifications in the adjustment. But it is unclear if such modifications were made after the nominal GDP estimates were systematically deflated. Nevertheless, by assuming that the 1992 benchmark was problem-free, NBS faced more complicated price problems. This assumption simply means that the undercoverage problem is mainly due to the new products or services that only emerged after 1992. Since the growth of new products/services is very price-sensitive, their prices are usually high at the early stages and decline quickly throughout the stages of maturing. It is therefore almost impossible for NBS to introduce a new trend to adjust the original price changes in the absence of necessary price information for new products or services. Then, how did NBS solve the price problem in the adjustment? Our rather heroic working hypothesis is that NBS did not *directly* work on prices. It is likely that they began with a new GDP growth trend that could satisfy a certain growth target for the period in question and then followed the trend-deviation

interpolation method to adjust the original annual real growth rates. In other words, the new (adjusted) deflators shown in Figure 3 are merely *indirect* results of the real growth rate adjustment rather than actual price changes that are independent of the adjustment.

Then the following questions are: What is the official growth target? How could that target affect NBS's adjustment of growth estimates? Back to the central planning era, the "state of art" of the planning administration in China was "leaving room (*liu you yu di*)" for fulfilling annual or five-year plans (FYPs). Since undershooting the planned target were politically unacceptable, economic authorities at all levels tended to leave enough "room" so that they could easily meet or even exceed their targets. As Table 4 shows, there was virtually no target undershooting in any of the FYPs since the 1980s.² However, it shows that the extent to which the target was exceeded varied greatly. This is largely a consequence of a game between lower and upper planning authorities. A great excess of the planned target (as seen in the 6th and 8th FYPs, Table 4) often sends a signal to the upper authorities indicating that lower authorities might have deliberately left too much "room" in the current plan. Thus, in the next FYP the central authorities tend to set a higher growth target to maximally tap the potentials. Yet, this may leave little room for overfulfilling the plan. In such a case the plan may be just met or marginally overshoot (as seen in the 7th and 9th FYPs). One could also interpret this result as a warning from the lower authorities that if such a high target is to be maintained, there may be a good chance to miss it. We could see that a marginal excess of the target is often followed by a downward adjustment of the planned target in the next FYP (as seen in the 8th and 10th FYPs).

TABLE 4: GROWTH TARGET AND ACTUAL GROWTH ACHIEVED IN CHINA'S FIVE-YEAR PLANS (FYPs)
(In percent)

Five Year Plan (period covered)	Growth target	Target adjusted compared with the last FYP ^a	Growth rate achieved	Growth target overshot (+) or undershot (-) ^b
The 6 th Five-Year Plan (1981-1985)	4.0		10.7	167.5
The 7 th Five-Year Plan (1986-1990)	7.5	87.5	7.9	5.3
The 8 th Five-Year Plan (1991-1995)	6.0	-20.0	12.0 (12.3) ^c	100.0 (105.0) ^c
The 9 th Five-Year Plan (1996-2000)	8.0	33.3	8.3 (8.6) ^c	3.8 (7.5) ^c

² This is also the case during the pre-reform period, but it is beyond the scope of this study.

The 10 th Five-Year Plan (2001-2005)	7.0	-12.5	8.8 (9.4) ^c	25.7 (34.3) ^c
The 11 th Five-Year Plan (2006-2010)	7.5	7.1		

Sources: Information on the growth target of various five-year plans is available from ECACE (various annual volumes) and the website of NDRC (National Development and Reform Commission) (<http://ghs.ndrc.gov.cn/>). The GDP growth rate for 2005 is 9.9% (as reported by the New China News Agent, March 6, 2006), which is used for calculating the average growth rate of the 10th FYP.

Notes: a) Calculated as (current target rate/previous target rate – 1)*100.

b) Calculated as (actual rate/target rate – 1)*100.

c) Calculated using the recent adjusted growth rates by NBS.

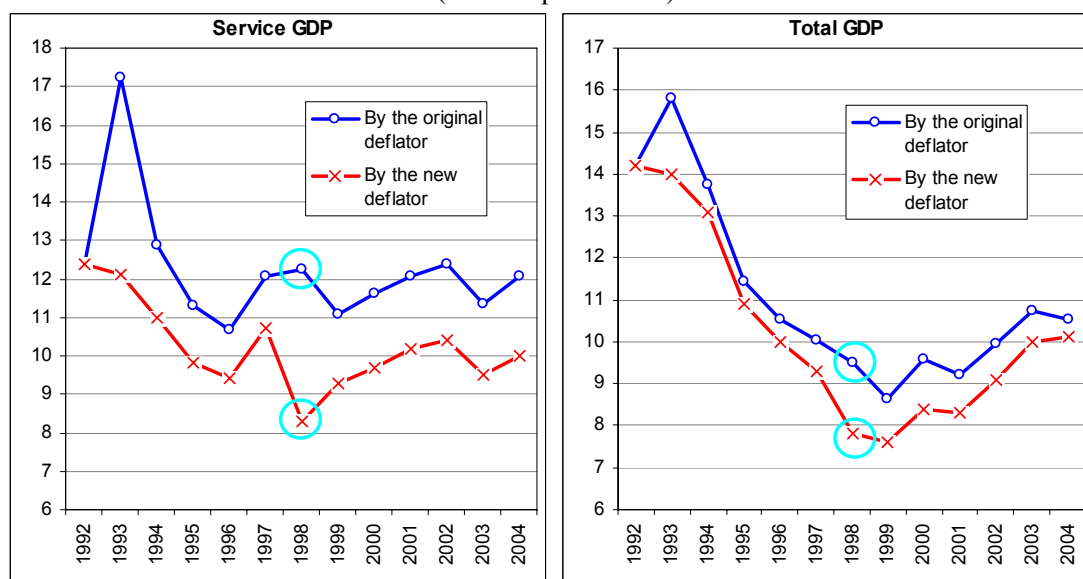
In such a process, changes in national plans can be rather erratic and hence the macroeconomic performance tends to be volatile. The situation began to change in the early 1990s when the market was allowed to play more important roles in economic decisions. Around the mid-1990s, the authorities began to exercise monetary and fiscal policies to replace the traditional planning administration, aiming to smooth out aggregate volatility. The highly volatile or stop-go macroeconomic performance under the Zhao Ziyang's and Li Peng's administration from the mid 1980s to the mid 1990s has taught the later governments some important lessons: the growth should not be too fast to maintain necessary macroeconomic balances, especially energy, minerals and transportation, but it should be fast enough to create jobs and hence reduce the pain of the reform of the state sector. Yet, how fast is just fast enough? The leadership's "rule of thumb" is close to but not more than 10 percent a year. This has been seen in discussions of various central governments' think tanks. For example, Liu (1999) described an ideal policy goal as "high growth (9% or below 10%) and low inflation (3%)". This should be, nonetheless, taken as the actual performance not the target growth rate. In fact, from Table 4, what we have observed in the game of planning is still in place: a lower target that gives enough room to overshoot. But the process has become a lot smoother.

Given this "rule of thumb" and the growth that had already been achieved, there was really not much room for NBS to play in the adjustment. On the one hand, NBS had to justify its emphasis on services in the census to support its strong belief that the service GDP had been indeed underestimated, which must have some positive bearing on the overall growth; on the other hand, it might be politically difficult to downward adjust the real growth rate of any other sectors (this point will be further discussed). NBS might have tried several scenarios in the adjustment, but it looks that an annual

growth rate of 9.9 percent was the most acceptable rate for the period 1992-2004.³ Since the impact of this upward adjustment on the entire reform period is merely 0.2 points (up from 9.4 to 9.6), this result may not significantly aggravate international critics who have believed that China's post-reform GDP growth performance has already been exaggerated (e.g. Maddison, 1998 and 2006).

To support our hypothesis, firstly, we would like to see what would be the effect on China's GDP growth rate if NBS just used the original GDP deflators. Or by how much it would miss the official target if NBS did so? Our results show that other things being equal, if the original NBS price deflators were used, the annual growth rate of China's GDP in 1992-2004 would be 10.8 per annum, further raised by 0.9 percent from the revised rate of 9.9 percent. This means that if the "rule of thumb" target rate was indeed 10 percent or slightly below it, using the original deflator would certainly overshoot the target.

FIGURE 4: WHAT IF THE ORIGINAL DEFLATORS WERE USED?
(Percent per annum)



Source: Table 1.

Figure 4 shows the effect of the original and the new deflators upon the real growth. The newly adjusted NBS nominal total and service GDP data are deflated by the two deflators. In fact, the series deflated by the new deflators are the same as those

³ The rate has been rounded up. More precisely it should be 9.87% if we use two decimal points.

shown in Figure 1 (the one labeled with “adjusted” in Figure 1), while the series deflated by the original deflators are from our calculation.

The results on annual changes are clearly self-explanatory. If the original price deflators were used, firstly, the already over-heated economy in 1993 as suggested by the original data would be much worse (more out-of-control growth) than what was then admitted by the authorities. Secondly, the Li Peng Administration highly claimed “soft landing” in 1996 would become less “soft”: dropping from the peak of 15.8 percent in 1993 (the time when Zhu Rongji, then the Vice Premier, began to clean up the mess of the central bank) to 10.5 percent in 1996 rather than from 14.0 to 10.0 percent as suggested by the original estimates. Thirdly, the widely criticized overstatement for the performance in 1998 when China was badly hit during the Asian financial crisis would look even more exaggerated (9.5! instead of 7.8). All these are politically difficult to accept. Therefore, in the absence of “satisfactory” deflators, it is inevitable for NBS to directly work on the real growth adjustment with some pre-set rates that could ensure the government’s “rule of thumb” growth target to be met.

To investigate the actual procedures adopted by NBS to work out the real GDP growth we begin with the new “trend rate” of 9.9 percent (see Equation (1b)) for the whole economy in 1992-2004. Then, we use this growth rate to generate a series of “trend values” as a 1992-based index (Equation (2b)). Next, we adjust this index by a set of deviation parameters obtained from the original real output index also with 1992 as the benchmark (Equation (4), equivalent to Equation (3)). The same exercise is done for every sector. Here, we follow NBS to assume that there is no price effect on the output of the non-service sectors (see Panel C, Table 2).

TABLE 5: REAL GDP GROWTH INDEX USING EQUATION (4) AND ITS COMPARISON WITH THE ESTIMATES BY NBS

	Equation (4)-derived Growth Index					Growth Index Ratio (NBS Index = 1.000)				
	Total	I	II (M)	II (C)	III	Total	I	II (M)	II (C)	III
1992	100.0	100.0	100.0	100.0	100.0	1.000	1.000	1.000	1.000	1.000
1993	114.0	104.7	120.1	118.0	112.2	1.000	1.000	1.000	1.000	1.001
1994	129.0	108.9	142.8	134.2	124.6	1.000	1.000	1.000	1.000	1.001
1995	143.1	114.3	162.8	150.8	136.9	1.001	1.000	1.000	1.000	1.002
1996	157.6	120.2	183.1	163.6	149.6	1.002	1.000	1.000	1.000	1.001
1997	172.2	124.4	203.8	167.9	165.4	1.002	1.000	1.000	1.000	1.000
1998	186.5	128.7	222.0	183.0	181.6	1.006	1.000	1.000	1.000	1.013
1999	200.6	132.3	240.8	190.9	198.1	1.006	1.000	1.000	1.000	1.012
2000	217.6	135.5	264.4	201.7	217.1	1.007	1.000	1.000	1.000	1.010

2001	235.0	139.3	287.5	215.4	238.4	1.004	1.000	1.000	1.000	1.007
2002	255.7	143.3	316.2	234.4	262.6	1.001	1.000	1.000	1.000	1.005
2003	281.2	146.9	356.7	262.8	286.9	1.001	1.000	1.000	1.000	1.002
2004	309.3	156.2	397.7	284.1	314.9	1.000	1.000	1.000	1.000	1.000

Sources: Author's calculation. See the text for the methodology used.

Table 5 reports the results. As expected, our interpolation (based on Equation (4)) results are very close to the adjusted real growth rates by NBS (here the NBS figures are also converted to 1992-based indices). This can be seen from the comparison of two estimates by a ratio with the NBS estimates as the benchmark (=1). This ratio confirms that firstly, for all non-service sectors our results exactly replicate what reported by NBS; secondly, for services there again observed some *ad hoc* downward modifications made to the results obtained by our interpolation procedures. Logically, such modifications effects create what we call “real gaps” that should be compensated by opposite price effect, which will be discussed below.

TABLE 6: COMPARISON OF IMPLICIT GDP DEFLATORS: EQUATION (4) RESULTS VERSUS THOSE BY NBS

	Implicit GDP Deflator					Deflator Ratio (NBS Index = 1.000)*				
	Total	I	II (M)	II (C)	III	Total	I	II (M)	II (C)	III
1992	100.0	100.0	100.0	100.0	100.0	1.000	1.000	1.000	1.000	1.000
1993	115.4	113.4	114.9	135.8	114.2	0.992	1.000	1.000	1.000	0.975
1994	139.4	150.0	132.6	156.2	140.1	0.993	1.000	1.000	1.000	0.978
1995	158.7	181.3	149.0	174.8	158.5	0.994	1.000	1.000	1.000	0.985
1996	169.2	199.2	156.3	189.5	170.5	0.996	1.000	1.000	1.000	0.993
1997	172.2	197.7	157.0	194.6	179.7	0.998	1.000	1.000	1.000	1.000
1998	169.7	195.8	149.0	192.5	185.0	0.993	1.000	1.000	1.000	0.984
1999	167.8	189.6	144.8	191.5	188.2	0.994	1.000	1.000	1.000	0.988
2000	171.2	187.2	147.2	193.5	196.4	0.993	1.000	1.000	1.000	0.990
2001	175.2	192.1	147.4	194.6	204.9	0.996	1.000	1.000	1.000	0.993
2002	176.7	195.3	145.9	194.9	209.2	0.999	1.000	1.000	1.000	0.996
2003	181.4	200.3	149.8	201.5	215.0	0.999	1.000	1.000	1.000	0.999
2004	194.0	231.3	159.4	216.3	226.0	1.000	1.000	1.000	1.000	1.000

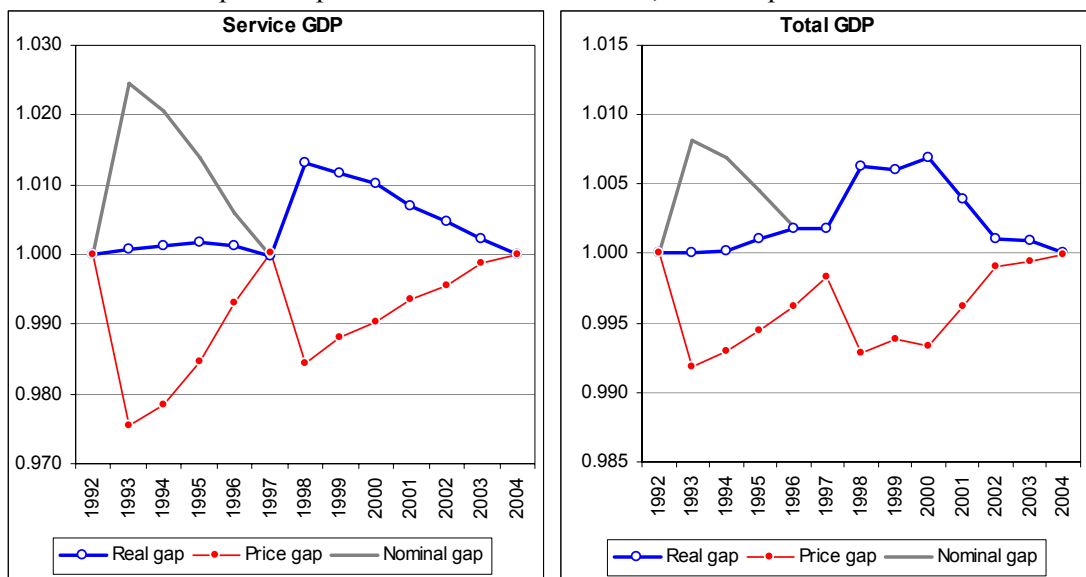
Sources: Author's calculation based on Tables 2, 3 and 5.

Next, in Table 6 using our estimates of both the nominal GDP (Table 3) and the real growth rates (Table 5), we work out the implicit GDP deflator for individual sectors and compare it with the newly adjusted deflators by NBS (Table 2) by a “deflator ratio” with the latter as the benchmark. If the ratio differs from one, it indicates some “price effect” created by *ad hoc* modifications to our estimates obtained through the normal interpolation procedures as given by Equation (4). We

shall call such effect in this context as “price gap”. In the current case, such “price gap” should be less than one as we expected. Our results indeed show that it is the case for the tertiary sector. We depict both “real gaps” and “price gaps” in Figure 4 and we expect they should mirror to each other. Apparently, without the introduction of “nominal gap” this is not the case. This certainly deserves further investigation.

Figure 4 shows that the implicit “price effect” of the NBS’s *ad hoc* modifications to the results by the standard procedures does not always “mirror” the degree of the modifications to the real growth. Taking 1993 as an example, the real GDP ratio is 0.1 percent above the benchmark ($= (1.001 - 1) * 100$), but the deflator ratio is 2.5 percent below the benchmark ($= (0.975 - 1) * 100$). How could this be explained? In fact, what are missing here are the NBS *ad hoc* modifications to the nominal values that we discovered earlier (Table 3). The implicit “price effect” should have also included the “nominal gap” created by the *ad hoc* modifications to the nominal estimates obtained by the standard interpolation procedures.

FIGURE 5: HOW MUCH HAS BEEN ARBITRARILY ADJUSTED AS SUGGESTED BY EQUATION 4? – “Gaps” compared with the NBS nominal, real and price estimates*



Source: Based on data from Tables 3, 5 and 6.

In fact, Figure 5 demonstrates what arbitrary modifications that NBS had to make in order to arrive at their desired growth rates. With the NBS adjusted real growth set as the benchmark ($=1$), no doubt that our lower deflators compared with that of NBS (<1) for the non-census points (i.e. years other than 1992 and 2004) are reflected by our higher real growth rates compared with those of NBS (>1). However, the “mirror

effect” only appears since 1997. For the period prior to 1997, the implicit price effect also captures the effect of the higher NBS new nominal estimates compared with what we could obtain by the standard approach. By incorporating the “nominal gaps” we could construct the full picture of the *ad hoc* modifications to the tertiary sector with the “mirror effect” for the whole period. For the total GDP, the “mirror effect” is virtually not that perfect due to the adjustment to other sectors.

4. WHAT IF ANY OF THE TWO BENCHMARKS IS UNRELIABLE?

So far we have not challenged any of the two benchmarks set by the census results for 1992 or 2004 used by NBS in the adjustment. Apparently, the adjustment based on the deviation of the old trend from the new one is acceptable only if the new trend is accurate. This adjustment improperly assumes that the estimates based on the 1992 tertiary census are accurate, which is opposite to the belief of many NBS statisticians that some “important services” were not covered or at least not sufficiently covered both in 1992 and afterwards. One may argue that in an extreme case, if the degree of the undercoverage or underreporting was more or less the same back in 1992, there is no justifiable reason for adjusting the real growth rate. However, as many may argue, with continuous efforts made by NBS over the past decade to improve its statistical work including statistical coverage, the undercoverage problem might have been improved overtime, therefore the growth rate should be adjusted downward rather than upward.

Our next question is whether the 2004 census results are reliable. There are a number of important problems observed in the regular statistics were addressed in the census, which further substantiate our skepticism. The first problem is the serious discrepancy between local and national accounts. China’s regional GDP estimates have been persistently higher than national estimates, which is largely driven by the political incentives of localities. As disclosed by Li Deshui, the former Head of NBS, at the 2005 CPPCC in Beijing, if regional estimates were used instead, China’s GDP in 2004 would be 2658 billion more and its growth rate would be 3.9 percentage points higher than the NBS figures estimated based on the information through its regular reporting system (reported by a Chinese newspaper *Southern City Herald*, March 8, 2005). Ironically, this 2658 billion yuan of likely data inflation is

coincidentally close to the 2300 billion of underestimation discovered by the 2004 census.

Li's point was made just after the 2004 census or at the early stage of the work on the census data including crosschecking, but why eventually there is no any information on how serious the over-reporting problem by localities as discovered in this census. As the serious discrepancy between regional and national GDP accounts has been hanging there for over a decade, it is very reasonable to assume that NBS would have taken this census as a good opportunity to investigate the likely causes of the discrepancy. Nevertheless, the adjustment by NBS appears to assume that the only possible problem of China's GDP estimation has been the underestimation of service output.

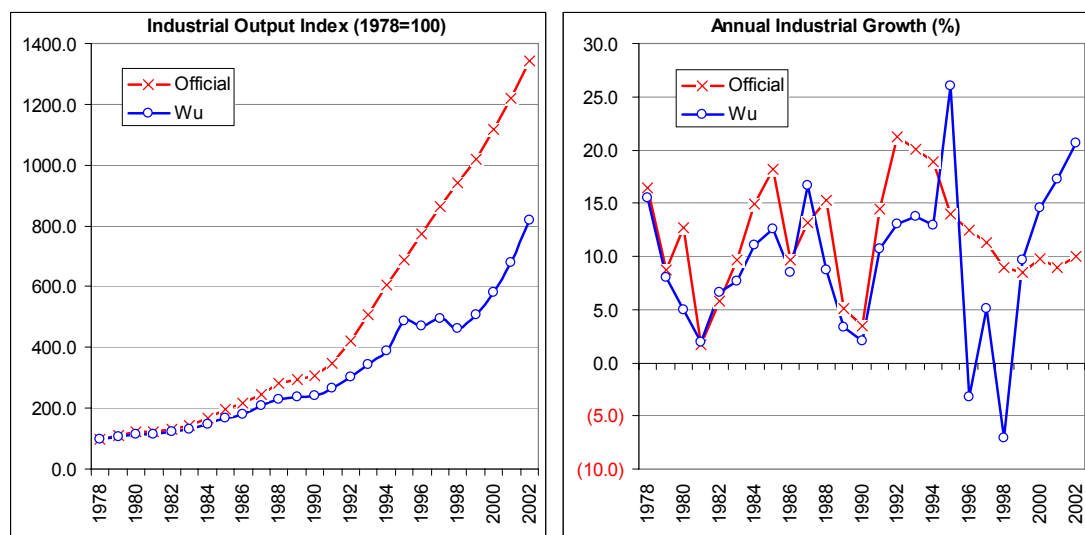
Further more, it is difficult to accept that other sectors are problem-free. The "regular reporting system" has been widely criticized for misreporting not only for services but also for manufacturing industries and one of the main purposes of the national economic census in 2004 is to compensate for the deficiencies of that system. According to Xu (2002), NBS has to downward adjust rural industrial output since the 1990s after they discovered in the 1995 industrial census that 40 percent of the rural industrial output was overstated. In fact, some very serious data fabrication cases were found even during the 2004 Census,⁴ suggesting that over-reporting of manufacturing output at or below township level could be a big problem. Why at the end didn't the census discover any significant output overestimation in industries?

In Figure 6, I report the preliminary update of my physical output-based estimation for China's industrial growth that challenges the official estimates (Wu, 2002). It extends my previous estimates from 1997 to 2002. It shows that over the period 1978-2002 China's industrial growth was 16.2 percent per annum compared with the official figure of 20.4 percent per annum. My estimates also suggest negative industrial growth in 1996 (-3.2 percent, at the time when the authorities claimed a "soft landing") and 1998 (-7.1 percent), which is in line with overall macroeconomic performance in China and the situation in the world economy especially the Asian

⁴ For example, one of the serious data fabrication cases disclosed is that the authorities of Maiwang Town, Hubei Province, assigned village officials with "income quotas" which were supposed to be filled into the census questionnaires. As a result, 80 million yuan business income by private firms was blown up to 1009 million, or 12.6 times the actual value that was discovered by a NBS taskforce after an anonymous informant reported to the census authorities (*Southern Weekly*, 2 June, 2005). One may reasonably wonder if this case is only the tip of iceberg.

financial crisis. In addition, the figure demonstrates that the official series of annual growth since the early 1990s is less volatile than my series, suggesting that the actual volatility in industrial production might have been smoothed out.

FIGURE 6: OFFICIAL ESTIMATES MAY HAVE EXAGGERATED CHINA'S INDUSTRIAL GROWTH AND SMOOTHED OUT INDUSTRIAL VOLATILITY, 1978-2002



Source: Author's preliminary estimates that update his results published in *Review of Income and Wealth*, 48:2 (2002).

5. A CONCLUDING REMARK

The census is unquestionably one of the statistical authorities' serious efforts to improve the Chinese national accounts. Yet, the legacies of the traditional system and political constraints have limited its effect. In this study we have played a detective role in an attempt to find out how the recent adjustment was made. There are still a lot of problems ahead before we could arrive at more solid conclusion about the real growth performance of the Chinese economy. In this final remark, we could only touch the always tempting question, "How fast has the Chinese economy grown?" by quoting Angus Maddison (2006)'s recent update of his estimate for China's GDP growth.

Maddison incorporates his work on agriculture and services with my work on industrial output including the above cited preliminary update to my earlier estimates of China's industrial growth. By converting the nominal values into the 1990 international Geary-Khamis dollars, Maddison shows that China grew at 7.9 percent per annum in the period 1990-2003 (a period largely overlapping with the period in

our current case) that could be compared with the official rate of 9.9 percent per annum. He has not taken into account NBS's recent upward adjustment by 0.5 percent. If we can accept the NBS's adjustment, Maddison's estimate will be raised to 8.4 percent per annum. Although this is still 1.5 percentage points below the official growth rate, it is a rate that could quadruple the Chinese economy in less than 18 years, which means that it easily overshoots Deng Xiaoping's and his successors' growth targets. However, if the growth rate estimated by Maddison is closer to the reality than the official growth rate, it will seriously challenge any exiting growth accounting results if the current measure of input growth is acceptable.

REFERENCES

- Blades, Derek (2004), *Interpolation Methods*, paper presented at the NBS/ADB Workshop on Improving Service Statistics, Shanghai, November 17-18, 2004.
- ECACE (Editorial Committee of *Almanac of China's Economy*) (various issues), *Almanac of China's Economy*, Beijing: Almanac of China's Economy Press
- Keidel, Albert (1992), How Badly do China's National Accounts Underestimate China's GNP? *Rock Creek Research Inc. Paper*, E-8042, 1992.
- Keidel, Albert (2001), China's GDP expenditure accounts, *China Economic Review*, 2001, Vol. 12 (4): 355-367
- Klein, Laurence R. and S. Ozmuur, The estimation of China's economic growth rate, paper presented at the UN Project Link meeting, April 2002
- Liu, Yingqiu (1999), *Macroeconomic policy choice at the semi-high growth stage* (cigao zengzhang jieduan de hongguan jingji zhengce xuanze), mimeo, Institute of National Land and Regional Development, Beijing.
- Maddison, Angus (1998), *Chinese Economic Performance in the Long Run*, OECD Development Centre, Paris, 1998.
- Maddison, Angus (2006), Do Official Statistics Exaggerate China's GDP Growth? A Reply to Carsten Holz, *Review of Income and Wealth*, 52: (1).
- NBS (National Bureau of Statistics). 2006. *Announcement of the Adjustment of Historical Statistics of China's Gross Domestic Product*. Beijing: National Bureau of Statistics.
- NBS. 2005. *China Statistical Yearbook 2005*. Beijing: China Statistical Press
- Rawski, Thomas G. (2001), What is happening to China's GDP statistics? *China Economic Review*, 2001, Vol. 12 (4): 347-354
- Ren, Ruoan (2002), How inflated is China's GDP statistics? – Comment on methodological issues of two studies on China's GDP statistics. *Economics (Quarterly)*, Vol. 2 (1), Beijing
- Ren, Ruoan (1997), *China's Economic Performance in An International Perspective*, OECD Development Centre, Paris

- Shiau, Allen (2005), Has the Chinese government overestimated the economic growth? in Yue Ximing, Zhang Shuguang and Xu Xianchun (eds.) (2005), *China's Economic Growth: Studies and Debates* (Zhongguo Jingji Zengzhuang Sudu: Yangjiu yu Zhenglun), CITIC Publication, Beijing.
- Woo, Wing Thye (1996), Chinese Economic Growth: Sources and Prospects, paper presented at Economics Discipline Seminar, RSPAS, Australian National University
- Wu, Harry X. (2002), "How Fast has Chinese Industry Grown?-Measuring the Real Output of Chinese Industry, 1949-97", *Review of Income and Wealth*, 48: (2) 179-204.
- Wu, Harry X. (2000), China's GDP Level and Growth Performance: Alternative Estimates and the Implications, *Review of Income and Wealth*, 46: (4) 475-499.
- Xu, Xianchun (2002), Study on Some Problems in Estimating China's Gross Domestic Product, *Review of Income and Wealth*, 48: (2) 205-215.
- Yue, Ximing and Zhang Shuguang (2002), "Woguo fuwuye zengjiazhi de hesuan wenti (Problems in measuring China's service value added)", *Jingji Yanjiu (Journal of Economic Research)*, No.12.