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THE REAL GROWTH OF CHINESE INDUSTRY REVISITED

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ABSTRACT

This study revisits the debate of the real industrial growth performance in China by tackling two unsolved problems: substitution bias and effect of value added ratio change in Laspeyres quantity index. This new exercise is based on a substantially revised and updated time series of major industrial product quantities for the period 1949-2006. Price weights are used for product level aggregation. Benchmark year input-output table gross output and value added data are used for industry level index construction and inter-industry aggregation. To test for the Gerschenkron effect, three benchmark years 1987, 1992 and 1997 are used incorporated with full input-output tables for these years. Thus three sets of quantity output indices are constructed and compared. The results are a systematic and substantial improvement to the author's earlier work (Wu, 2002, RIW). Our findings lend a strong support to the upward bias hypothesis about the Chinese official growth estimates. For the period 1980-2006 that experienced unprecedented structural changes, our estimation for China's industrial GDP growth is finally a geometric mean of the three quantity indices. It is 9.4% per annum, which is 2.1 percentage points lower than the official estimates.

Key words: Laspeyres quantity index, Gerschenkron effect, value added ratio, industrial growth in China

JEL codes: C43, O47

I. INTRODUCTION

China's post-reform transition from MPS to SNA has been crippled by its continuous practice of the Soviet-style "comparable prices"-based deflation approach that not only introduces segmented weights to time series, which exaggerates the real growth, but also creates leeway to over-report real output. This upward bias hypothesis was supported by Wu (1997 and 2002) using quantity of major industrial products or product groups weighted by input-output table value added weights for 1987 (implying 1987 constant prices). Wu's earlier estimates for 1952-1995 (Wu, 1997) were incorporated in Maddison's reestimation of China's post-war GDP growth (1998). In 2002, Wu improved his estimates by increasing the number of products and introducing intra-industry value weights (industry as classified in the Chinese input-output tables) using detailed product price data from the National Bureau of Statistics (NBS). The straightforward updates of the Wu index were preliminarily reported in Wu (2007), and adopted in Maddison (2007) and Maddison and Wu (2008). The updated results suggest that the official estimate of China's industrial GDP growth may have been overestimated by 1.75 percentage points for the period 1978-2003, i.e. official estimate of 11.50 percent per annum compared to Wu's 9.75 percent per annum. As for the pre-reform period 1952-78, the official estimate may have been exaggerated by 1.32 percentage points, i.e. 11.46 percent per annum compared to Wu's 10.14 percent per annum.

Wu's findings support the upward bias hypothesis about the Chinese official growth estimation proposed in earlier studies (Adams and Chen, 1996; Keidel, 1992 and 2001; Maddison, 1998; Ren, 1997; Woo, 1998; Rawski, 1993 and 2001). Nevertheless, Wu's the quantity output index approach is not unchallengeable. A challenge has come from Holz (2006).[1] However, his challenge missed the right target or the main deficiency of the approach and ignored the likely bias in the results that are in fact warned by Wu (2002). Instead, not only did he carry on the problem of the approach but also simplified it by applying it to a cross country case, meanwhile completely ignored the underlying classical index number problems. As we show in

[1] See Maddison's rebuttal to Holz in the same issue of the *Review of Income and Wealth* (2006). However, the key issues discussed in this study were not sufficiently discussed in Maddison's short reply.

this study, Holz's oversimplified work neither implies that the official estimates of industrial growth rate are flawless[2] nor Wu's estimates are implausible.

In Maddison and Wu (2008), we recapped the likely bias in Wu's estimates. We reviewed two major potential problems. The first one is the strong assumption that value added ratio or the ratio of gross value added to gross value of output (=GVA/GVO) in the 1987 input-output table remained unchanged. However, if the ratio has increased over time, growth would be underestimated; if it declined, growth would be exaggerated. Based on data on net material product (NMP), Wu and Yue (2000) already show that for the industrial sector as a whole the ratio remained stable before the mid-1980s but declined afterwards (p.92, Table 2). However, more detailed information from China's input-output tables suggests that the ratio declined over the entire post-reform period except for a short resurgence in the early 2000s. In 1987, the ratio was 32 per cent if measured by the net material product (NMP) approach as in Wu and Yue (2000) or 34 by the value added approach (Wu, 2002, p.193). It declined to 29 in 1995 (Wu, 2002, p.193), 28 in 2000 (NBS, 2004, pp. 71-73), and rose to 30 in 2002 (DNEA, 2006, pp. 84-89). In this study this has been substantially investigated, which has further confirmed the decline of the ratio up to 2005 (see our new estimates presented in Table 2 and Figure 3). Therefore, Wu's alternative estimates for this period still exaggerate real growth.

A second potential problem is substitution bias that is also well known as the Gerschenkron effect (1951). Changes in prices are negatively correlated with changes in quantities of commodities (if buyers are rational), a quantity index based on prices after the base year would fall short of an index using base-year prices. In other words, the fixed-weight quantity index will overstate growth rate for the years after the benchmark and understate earlier growth. Wu and Yue (2000) show that if the benchmark were changed from 1987 to 1992, using the 1992 input-output table weights while keeping all others unchanged, China's industrial growth rate would be further lowered by about 1 percent per annum for 1978-97, and raised by 0.1 percent for 1952-78. The current study makes a substantial effort to investigate the

[2] However, in his recent short article, Holz changed his view and argued that, yet with little empirical support, the growth estimates by local governments were more reliable and closer to the true growth rate than the work by NBS (Holz, 2008).

Gerschenkron effect in the previous estimates by introducing two benchmarks of 1992 and 1997 to the exercise.

We now consider the third problem. In the previous exercise, the quantity indices constructed by available products (the so-called CIES items from *China's Industrial Economy Statistics Yearbook*; see Wu, 2002) were multiplied by the industry level gross value-added given in the Chinese input-output table (CIOT). The industries at this level are the CIOT industries that are close to the 3-digit level industries of Chinese standard of industrial classification. This however not only assumes that the gross value of output has the same growth rate as GVA, a problem that we have just discussed, but also inherently illogical because the price weighted and aggregated commodities are in face in gross value not in value added terms. A more logical alternative is to multiply the CIES products-identified output indices by GVO, and then adjusted by proper GVA/GVO ratios, ideally at the same industry level. This is part of the new approach that is attempted in the current study.

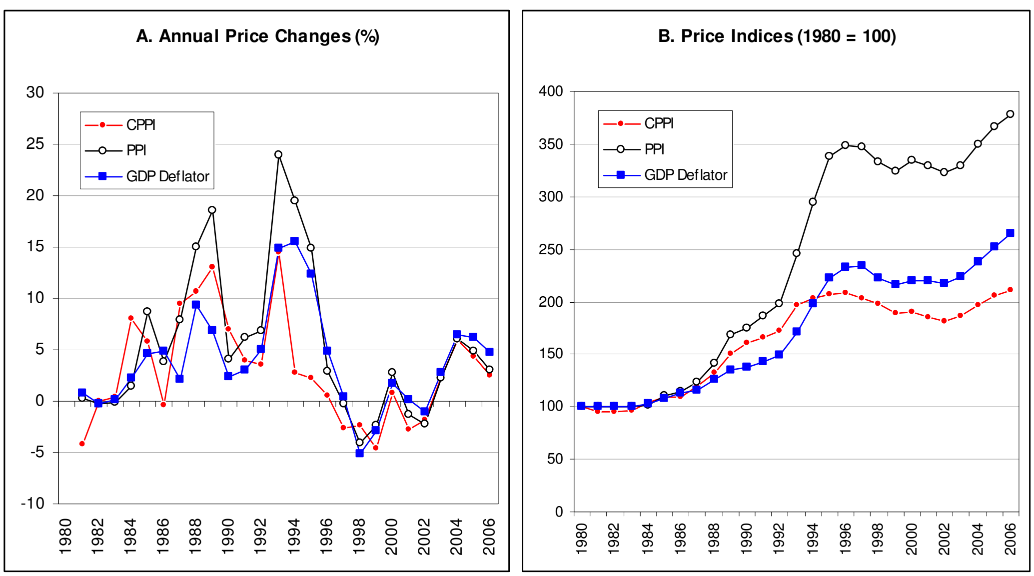
One of the motivations behind the earlier studies was that volume movements would be better gauge the real growth since it could bypass official problematic price data or inflation measures as well as upward bias due to institutional problems in data reporting (exaggerating growth due to political reason). Despite of tremendous efforts made by NBS, problems in price measurement have not gone. Evidence has shown that the price problem has been further complicated by the recent adjustment of real growth rate following China's first Economic Census for 2004. Wu (2007) found that the post-census adjustment bypassed deflator problem and was made directly to the real output, which implicitly "adjusted" underlying prices. After replicating the adjustment procedures using the standard interpolation approach, Wu also found that the earlier reported NBS estimates were arbitrarily modified and the adjustment deliberately left 1998 intact.[3]

To demonstrate the complicity of the price problem in the estimation of real industrial output, in Figure 1 we present three official price indices for the industry as

[3] The problem of the post-census adjustment is more to do with services. However, we have reservations about the adjusted growth rate also because it is not clear whether all of the underreported service output discovered by the census should have been assumed to occur after 1992. If the extent of underreporting was similar prior to 1992, no adjustment is needed, and if it was higher, which is not unlikely because one may reasonably assume that official statistical practices have been improving over time, the growth rate should be downward rather than upward adjusted.

a whole (including manufacturing, mining and utilities), namely, comparable price index (CPPI) adopted under MPS and used until 2003, producer price index (PPI) and an implicit GDP deflator for industry. A note to Figure 1 explains where our data are obtained and how the indices are constructed. It should be noted that both CPPI and PPI refer to gross value of output, whereas the GDP deflator refers to gross value added. The annual fluctuations follow a similar pattern but to different degrees. CPPI appear to be the least volatile index while PPP is most volatile. The GDP deflator stays in between. Intuitively, it follows that if the nominal output is given, CPPI suggests the highest real growth, whereas PPI implies the slowest growth, leaving the GDP deflator again in the middle. It is never clear what deflation procedures that NBS follows to estimate the real value added. However, Panel B implies that the (underlying) value added ratio must be high and rapidly growing to compensate high and rising input prices that should be captured by PPI. This chart casts a big puzzle that justifies the effort in the current study.

FIGURE 1: ALTERNATIVE OFFICIAL PRICE INDICES FOR INDUSTRIAL OUTPUT



Sources & Notes: Basic data for calculating comparable price index (CPPI) are from *China Industrial Economy Statistical Yearbook* (DITS, various issues) and data for calculating the implicit GDP deflator are from *China Statistical Yearbook* (NBS, 2007, pp.57 & 59). PPI data are directly from *China Statistical Yearbook* (NBS, 2007, p.330). CPPI is calculated using the "comparable price"-approach estimated industrial GVO and nominal GVO available at industry level. Such data were stopped after 2003. Internal source confirmed that NBS stopped using this approach at least in this part of statistics. To compare with other indices presented here, we assume that CPPI in 2004-06 follows the changes of PPI in all industries, and the so-derived changes for industries are used to estimate changes over this period for the industry as a whole. The implicit GDP deflator is simply derived as the difference between nominal and real growth indices of industrial GDP. The nominal growth index is calculated using NBS nominal GDP data and the real industrial GDP index is directly from the NBS source.

The paper is structured into six sections. Section II recaps the upward bias hypothesis focusing on the Gerschenkron effect on Laspeyres index and problems in China's practice in the "comparable price" system. Section III presents the new estimation approach in this study. Data issues are handled in Section IV. Section V reports and discusses the results. We conclude the study in Section VI by providing a new set of constant yuan estimates for gross value added in total industry and its major sectors, manufacturing, mining and utilities and discussing implications for previous studies.

II. THE UPWARD BIAS HYPOTHESIS REVISITED

First of all, it is ignorant to believe that the "comparable price" system that China adopted in the early 1950s from the Soviet Union for estimating real output growth had little impact in the post-reform period (Holz, 2006). In fact, the last set of "constant prices" in the system is 1990 prices, which was in force for the period 1990-2003. This was however the time when the Chinese economy experienced the most rapid restructuring and price changes since the 1950s. It is one of the only two "constant prices" in the system that was used for the longest time – thirteen years in a row. The set of 1957 prices was also used for thirteen years in the period 1957-1970, but the economy in that period was tightly controlled by the planning authorities and virtually little market activity existed in industry in particular. The "comparable price" system assembled a GDP deflator from several sets of "constant prices" that are based on the average prices of "representative products" in benchmark years. On average, one set of "constant prices" would remain in use for about ten years. There have been five sets of "constant prices" based on 1952, 1957, 1970, 1980 and 1990, respectively. All the "constant prices" were administrative prices except for the 1990 prices which contained some market or semi-market prices as China was in the middle of a dual-track price system that was introduced to facilitate market oriented reforms.

Even if the "constant prices" used in the system could well represent the real prices in the base year, and there were no leeway to bypass the system, a 10-year interval is long enough to introduce substitution bias in any Laspeyres type of index, known as the Gerschenkron effect (Gerschenkron, 1951). The direction of the bias depends on the correlation between changes in prices and changes in quantities of commodities. Consider the case where the correlation is negative, implying that consumers are rational. In this case, commodities whose prices rise less rapidly will be substituted for those whose prices rise more rapidly. Therefore, the quantity index weighted by prices in an earlier year is higher than an index based on a later year because the former gives a larger weight than the latter to those commodities whose prices grow more rapidly. In other words, a fixed-weight quantity index will overstate growth rate for the years after the benchmark and understate growth rate for the years before the benchmark.

By the same token, linking the growth rates estimated using different sets of "constant prices" or assembling the growth rates in segmented weights over time also exaggerates the real growth. This can be easily shown with simple mathematics. The linking relies on the first year, usually used as the benchmark year, of each "constant price" period which is assigned with two sets of "constant prices", i.e. the "constant price" used in the last period and the "constant price" used in the current period. This does not apply to the first period in the "comparable price' system. This linking ensures that the base year of the last period can also be priced using the "constant price" of the current period. In what follows we show that the linking exercise with different "constant prices" will introduce significant upward bias in estimating real growth, a practice that is relevant to the case of China. We can show that using just one constant price, as the practice in many other countries, is better than linking multiple "constant prices" with segmented weights.

Assume we need to calculate the real growth between the first year of Period 1 and the first year of Period 3. Note that period here refers to "constant price' period in the system. Thus, three sets of "constant prices" are involved. The first year of a period is usually the benchmark year of the prevailing "constant prices". The first year of Period 2 is assigned with the "constant price" for Periods 1 and 2 and the first year of Period 3 is assigned with the "constant price" for Periods 2 and 3. Period 3 is the current period in the system. Following the Gerschenkron effect, we know that

(2.1) $$\frac{\sum p_c^1 q_c^2}{\sum p_c^1 q_c^1} > \frac{\sum p_c^2 q_c^2}{\sum p_c^2 q_c^1}, \text{ or}$$

(2.2)
$$\frac{\sum p_c^2 q_c^3}{\sum p_c^2 q_c^2} > \frac{\sum p_c^3 q_c^3}{\sum p_c^3 q_c^2}$$

where subscript c stands for constant price and superscripts denote different periods, i.e. 1, 2 and 3 in our case. We can ignore the time as in this example it always refers to the first year of a period. In our case, $p_c = p_0$, because the first of the base year is the benchmark year of the prevailing "constant prices".[4] Each side of the two inequations represents a real growth over the first year of two periods at a certain constant price. Let us now rearrange (2.1) and multiply it by the left hand side of inequation (2.2):

(2.3)
$$\frac{\sum p_c^1 q_c^2}{\sum p_c^2 q_c^2} \cdot \frac{\sum p_c^2 q_c^3}{\sum p_c^2 q_c^2} > \frac{\sum p_c^1 q_c^1}{\sum p_c^2 q_c^1} \cdot \frac{\sum p_c^2 q_c^3}{\sum p_c^2 q_c^2}$$

which can be further arranged as

(2.4)
$$\frac{\sum p_c^1 q_c^2}{\sum p_c^2 q_c^2} \cdot \frac{\sum p_c^2 q_c^3}{\sum p_c^1 q_c^1} > \frac{\sum p_c^2 q_c^2}{\sum p_c^2 q_c^1} \cdot \frac{\sum p_c^2 q_c^3}{\sum p_c^2 q_c^2}$$

Therefore, we can have

(2.5)
$$\frac{\sum p_c^1 q_c^2}{\sum p_c^1 q_c^1} \cdot \frac{\sum p_c^2 q_c^3}{\sum p_c^2 q_c^2} > \frac{\sum p_c^2 q_c^3}{\sum p_c^2 q_c^1}$$

This suggests that the estimated growth rate of Period 3 over Period 1 using two segmented "constant price" weights (Periods 1 and 2) (i.e. the left hand of the inequation) will be higher than only using the "constant price" of Period 2 (the right hand side of the inequation). Therefore, even if any Laspeyres system is not free of the Gerschenkron effect, an index with single fixed weights is less biased than one with segmented weights.

We are now considering another problem that is also related to the practice of the "comparable price" system but can be separated from the system's inherent Gerschenkron effect. In order to measure price changes and real growth, enterprises

[4] This will avoid confusion with the later notation when a base year could mean any earlier year in comparison with the current year within a period.

are given price manuals which specify the current period constant prices for them to use in regular statistical reports. However, these manuals cannot cover all items produced or specify them in sufficient details. This is particularly problematic when there are new products appear after the benchmark year on which the current constant prices are set. Enterprises have no guidance on how to properly price them. Since it is very complicated to turn new products into something equivalent in the benchmark year enterprises tend to report new products at current prices rather than converting them into "constant prices". This creates leeway for both enterprises (state firms in particular) and local governments to exaggerate the number of new products as well as to overprice them. A different but also similar problem in terms of violating the rule of using the assigned "constant prices" is that small-sized, non-state enterprises established after the benchmark year, many short lived, tend to report the same figures at both "constant prices" and current prices for convenience or just out of ignorance. Local governments also tend to close their eyes to such practice because of their political incentives to show faster growth (Li and Zhou, 2005; Ma, 1997; Rawski, 1993; Woo, 1998).

To more rigorously explain this "leeway effect", assume that output in any given period consists of two parts, one uses the assigned "constant prices" and another uses current prices or some prices that are different, logically higher than, the "constant prices". So the reported growth rate g^R between two periods (0 and *t*) can be defined as

$$g_t^{V(R)} = \frac{V_t^I + V_t^{II}}{V_0^I + V_0^{II}} = \omega_t^I \frac{V_t^I}{V_0^I} + \omega_t^{II} \frac{V_t^{II}}{V_0^{II}} \quad (2.6)$$

where $V_t^I = \sum p_c q_t$ and $V_0^I = \sum p_c q_0$, i.e. the first part (I) of the output is priced by "constant prices", p_c ($p_c \neq p_0$); $V_t^{II} = \sum \tilde{p}_t q_t$ and $V_0^{II} = \sum \tilde{p}_0 q_0$, that is, the second part (II) of the output is priced by current prices or something that is close to current prices, p_t; and $\omega_t^I = \frac{V_t^I}{V_t^I + V_t^{II}}$ and $\omega_t^{II} = \frac{V_t^{II}}{V_t^I + V_t^{II}}$ are the respective weights for the two parts of the output.

When $p_t > p_0 > p_c$ and ω^{II} grows rapidly as observed in the case of China, the reported growth rate can be significantly higher than the *actual* growth rate (g^A) that can be defined by its genuine concept, i.e.

(2.7) $$g_t^{V(A)} = \frac{\sum p_c q_t}{\sum p_c q_0}$$

Lastly, we can bring in the problem of value added ratio. Conceptually, even if we are only in the ideal case of equation (2.7) the so-calculated growth rate, can not be used as a good proxy for the growth of value added when the ratio of GVA to GVO is unstable. Let θ be the ratio and $g_t^{Q(A)}$ (the superscript Q stands for the real output of value added) be the real growth of GVA, when θ declines over time, we observe

(2.8) $$g_t^{V(R)} > g_t^{V(A)} > g_t^{Q(A)}\theta_t .$$

As we have discussed, all these problems are very complicated in nature and it justifies a comprehensive treatment as attempted in the current study.

III. METHODOLOGY

The methodology used in this study for constructing real output index for Chinese industry begins with a Laspeyres index approach. As discussed, this is to bypass the complicated price problems. To investigate the Gerschenkron effect, we will construct three sets of indices using 1987, 1992 and 1997 as the benchmark year, respectively. For these years, as explained later in the data section, detailed price surveys on industrial products and full version of input-output tables are available.

The exercise involves four major steps. The first step is to aggregate the commodities that are available from *China Industrial Economy Statistical Yearbook* or CIES items as terms in Wu (2002) into groups and exactly match them with the basic level of industries in a specific benchmark year input-output table (CIOT). Each CIOT industry may contain several commodity groups. Benchmark year price data are used in constructing group level indices and the gross values of output of CIOT industry are used to weight these commodity groups and obtain a CIES item-identified quantity index for each CIOT industry.

The second step is to estimate a complete GVO index for each CIOT industry by assuming the *unidentified* part of the output value in an industry to move together with the CIES *identified* part of the industry output value. At the end of this step, a time series of GVO at the benchmark period prices will be constructed.

The third step is to aggregate the CIOT industries into CIOT branches (roughly two-digit level industries) still using CIOT weights.

The last step is to estimate GVA by introducing industry level GVA/GVO ratios (θs) to the so constructed GVO at constant prices (which can be obtained in the second step). Three sets of GVA indices with different benchmark periods (1987, 1992 and 1997) can be derived. A geometric mean of these GVA indices is then calculated to minimize the substitution bias.

A simple mathematical expression for the method used is given as follows. Let q_{hij} be the quantity of the hth commodity (h = 1, 2, ..., l) of the ith commodity group (i = 1, 2, ..., m) in the jth industry (j = 1, 2, ..., n) and φ_{hij} be the weight for this commodity. The quantity index for the jth industry based on CIES items, $X_{j,t(T)}^{\mathrm{GVO,CIES}}$, is defined as:

(3.1)
$$X_{j,t(T)}^{\mathrm{GVO,CIES}} = \frac{\sum_{i=1}^{m}\sum_{h=1}^{l}\varphi_{hij,T}q_{hij,t}}{\sum_{i=1}^{m}\sum_{h=1}^{l}\varphi_{hij,T}q_{hij,T}}$$

where T denotes for the benchmark years, i.e. 1987, 1992 and 1997 in our exercise.

Equation (3.1) is in line with the approach of Laspeyres index, i.e. a fixed base-period weight index. As clearly shown in this equation, to compute the industry's GVO index, quantities of commodities within each industry have to be aggregated by proper weights, which is "*intra*-industry aggregation". The weights used to obtain the quantity index should be the producer prices in a given base year or the unit values for the same year that can be derived directly from the quantity and gross value of output of a commodity at factory gate. In our exercise, most products can satisfy this requirement, leaving a few for which some unweighted approach has to be used as explained in the data section.

To derive the CIOT industry-level GVO index that also includes the CIES unidentified component, we assume the trend of the unidentified component to follow that of the identified component. This is a strong assumption, but justifiable as we discussed in the data section. Therefore, we can have

$$GVO_{j,t(T)} = X^{GVO,CIES}_{j,t(T)} \cdot GVO^{CIOT}_{j(T)} \tag{3.2}$$

Following our earlier discussion of the value added ratio, a CIOT value added ratio (θ) can be calculated for each industry to derive GVA series at constant prices for a benchmark period T. For the jth industry, the calculation of GVA is based on the following formula:

$$GVA_{j,t(T)} = GVO_{j,t(T)}\theta_{j,t}, \text{ where } \theta_{j,t} = \frac{GVA_{j,t}}{GVO_{j,t}}. \tag{3.3}$$

IV. DATA (TO BE COMPLTED)

This section is to be completed with following contents:

1. Details of the available CIES commodities, problems that are identified in the published NBS series when being reconciled with relatively independent annual reports by authorities of individual industries (government body and used to be ministry level authorities) and adjustments made

2. Details of the price data used for weighting and aggregation, their problems, and adjustments, especially quantity weights used when price data are for more specified commodities while the CIES items are more general or refer to product groups without intra-group commodity details

3. Coverage issues or likely bias when some of the gross output cannot be identified by CIES products

4. Details of Chinese I/O data used and problems in interpolations between the available I/O tables for calculation of value added ratios

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The following are calculations to show that

1. Structural changes (Table 1) over the three benchmarks. It suggests that labour intensive industries grew more rapidly than capital intensive ones. Discussion will be focused on the implications of such changes on the index construction when the unidentified items are more labour intensive (??) and operated in small firms; then implications, and expected impact on the results

TABLE 1: CHANGE OF STRUCTURE IN CHINESE INDUSTRY OVER BENCHMARK YEARS

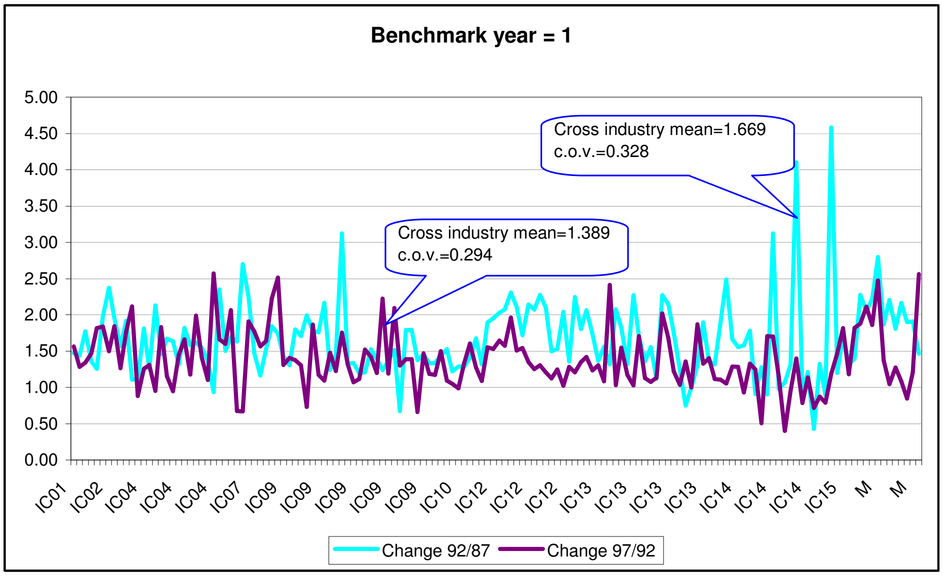
	Industry	Industrial Structure (total industry = 100)			Change of Industrial Structure (Base year = 1)	
		1987	1992	1997	1992/87	1997/82
IC01	Food products	9.14	7.33	9.41	0.80	1.28
IC02	Beverages	2.33	1.94	2.40	0.83	1.24
IC03	Tobacco products	2.13	1.82	1.43	0.86	0.78
IC04	Textile products	12.24	10.37	8.90	0.85	0.86
IC05	Wearing apparel	2.29	2.85	3.71	1.24	1.30
IC06	Leather products	1.14	1.29	2.13	1.12	1.66
IC07	Wood products	1.59	1.33	2.15	0.84	1.62
IC08	Paper, printing etc.	3.27	2.99	3.28	0.92	1.10
IC09	Chemicals, petroleum	13.06	12.36	13.67	0.95	1.11
IC10	Rubber, plastic products	3.45	3.65	4.04	1.06	1.10
IC11	Building materials	5.89	6.92	8.45	1.17	1.22
IC12	Metals	11.57	12.56	6.70	1.09	0.53
IC13	Machinery, transport equip.	13.26	14.55	13.00	1.10	0.89
IC14	Electrical equipment	7.25	7.03	8.65	0.97	1.23
IC15	Other manufacturing	2.98	4.12	1.82	1.38	0.44
	Manufacturing	91.60	91.10	89.75	0.99	0.99
	Mining	5.28	5.45	6.27	1.03	1.15
	Utilities	3.12	3.45	3.99	1.11	1.16
	Total industry	100.00	100.00	100.00		

Sources & Notes: Calculated from *Input-Output Table of China* for 1987, 1992 and 1997 (DBNE and ONIOS, 1991; DNA, 1996 and 1999).

2. We will also investigate price changes over the three benchmarks at commodity level. Figure 2 shows that variations of the cross commodity changes in prices in 1997/92 over 1992/87 declined, suggesting that market played more important role than in the earlier period of the reform;

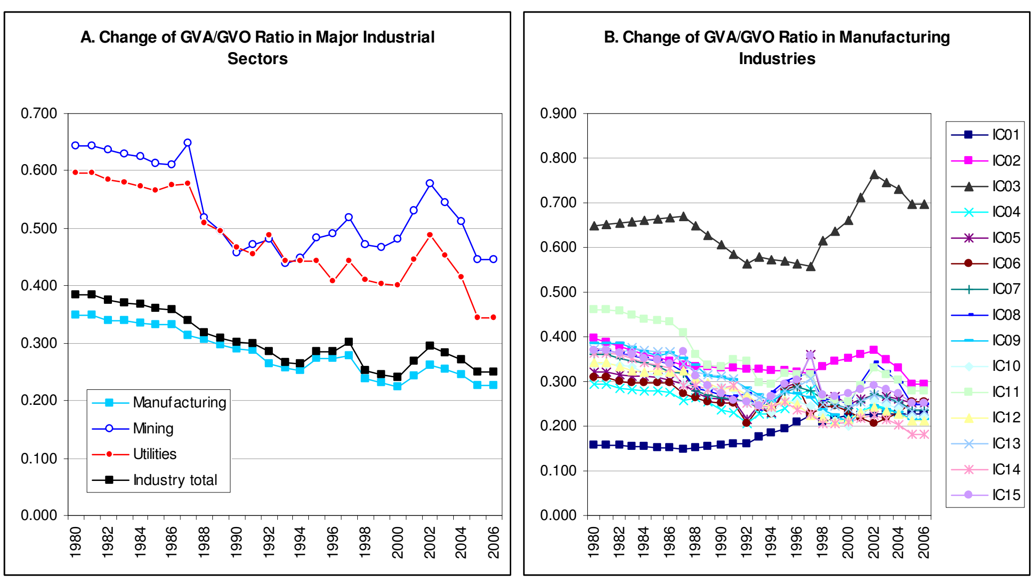
implications for benchmark selection – prices are more reasonable and the estimated Gerschenkron effect is also more meaningful

FIGURE 2: PRICE CHANGES OF CIES PRODUCTS (PRODUCT GROUPS) OVER THE BENCHMARK YEARS



3. With Figure 3 and Table 2 we discuss changes in value added ratios over time

FIGURE 3: CHANGE OF GVA/GVO RATIO IN CHINESE INDUSTRY



Sources & Notes: See Table 3 for the basic input-output table data used. The time series presented in the figures are constructed by interpolations between the input-output benchmarks. Since China's SNA type of input-output tables is only available from 1987, the pre-1987 estimates are directly from Wu and Yue (2000, p.97).

TABLE 2: CHANGE OF RATIO OF GROSS VALUE ADDED TO GROSS VALUE OF OUTPUT IN CHINESE INDUSTRY

		GVA/GVO Ratio						Change of the Ratio	
		1980	1987	1992	1997	2002	2005	1992/1980	2005/1992
IC01	Food products	0.159	0.152	0.162	0.224	0.226	0.228	1.02	1.41
IC02	Beverages	0.397	0.334	0.328	0.318	0.369	0.293	0.83	0.89
IC03	Tobacco products	0.649	0.649	0.563	0.558	0.763	0.697	0.87	1.24
IC04	Textile products	0.293	0.262	0.206	0.282	0.248	0.213	0.70	1.03
IC05	Wearing apparel	0.322	0.276	0.215	0.361	0.271	0.250	0.67	1.16
IC06	Leather products	0.309	0.263	0.205	0.226	0.205	0.255	0.66	1.25
IC07	Wood products	0.360	0.278	0.253	0.279	0.273	0.238	0.70	0.94
IC08	Paper, printing etc.	0.369	0.286	0.272	0.317	0.344	0.249	0.74	0.92
IC09	Chemicals, petroleum	0.386	0.336	0.285	0.265	0.245	0.216	0.74	0.76
IC10	Rubber, plastic products	0.341	0.304	0.252	0.245	0.257	0.221	0.74	0.88
IC11	Building materials	0.461	0.360	0.347	0.316	0.329	0.279	0.75	0.80
IC12	Metals	0.343	0.308	0.271	0.225	0.242	0.214	0.79	0.79
IC13	Machinery, transport equip.	0.373	0.321	0.278	0.307	0.270	0.232	0.75	0.83
IC14	Electrical equipment	0.365	0.290	0.252	0.228	0.226	0.181	0.69	0.72
IC15	Other manufacturing	0.371	0.312	0.255	0.357	0.292	0.252	0.69	0.99
	Manufacturing	0.349	0.307	0.265	0.279	0.262	0.227	0.76	0.86
	Mining	0.644	0.519	0.480	0.518	0.578	0.445	0.75	0.93
	Utilities	0.597	0.509	0.488	0.442	0.489	0.343	0.82	0.70
	Total industry	0.383	0.319	0.284	0.301	0.295	0.249	0.74	0.88

Sources & Notes: Calculated from *Input-Output Table of China* for 1987, 1992 and 1997 (DBNE and ONIOS, 1991; DNA, 1996 and 1999). Figures for 1980 are estimated by Wu and Yue (2000, p.97).

V. Discussion of Results (to be completed)

The first part of the results is reported in Table 3, which repeated what Wu did earlier (1997 and 2002) through with much better product series. However, it is new in that the exercise is carried out for two more input-output benchmarks. With results of three benchmarks, especially the benchmark 1997 stands on a much more reasonable position in terms of more market-oriented or less controlled economy, we can meaningfully explore the Gerschenkron effect, and hence to show if the earlier estimates are still upward biased. The second part of the results are reported in Table 4, which provide growth rates based on GVA rather than GVO that is assumed to go with the GVA as in the earlier exercise.

The following key observations from the results will be discussed:

1. Table 3 shows that the estimated Gerschenkron effect is much stronger for the reform period than for the pre-reform period. The overall growth, if based on 1987 weights, is much higher than if based on 1997 weights. The estimated annual GVO growth during the reform period changed from 12.12% with the 1987 weights, to 10.93% with the 1992 weights, and then to 9.76% using the 1997 weights, whereas in the pre-reform period, it firstly increased from 9.78 using the 1987 weights to 10.28 on the 1992 weights and then declined slightly to 10% using the 1997 weights but still higher than that of based on the 1987 weights. This upward change is expected as the period is before the first benchmark. The overall change was not that significant, if focusing on 1997 over 1987 in particular, which is also understandable because the economy was then under tight central planning control.

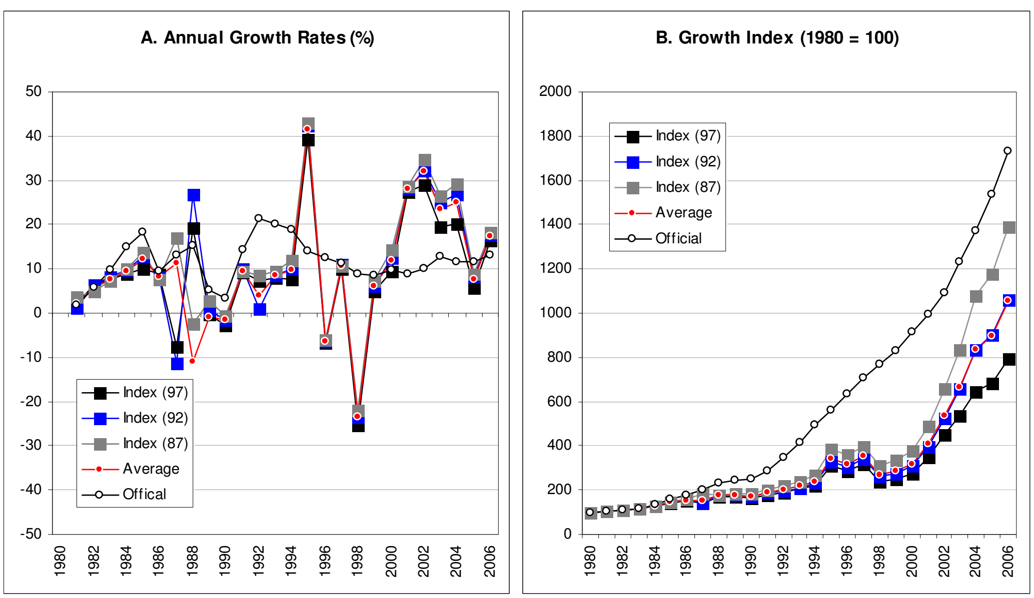
2. Table 4 compare GVA with GVO estimates only for the period since 1980 because we have insufficient information for estimating the value added ratio for the period before 1980 (will be attempted later but not available for this conference). In Table 4, we divide the period into two sub-periods, 1980-1993 and 1993-2006. Our comparison in this table includes both GVO and GVA estimates. The estimated GVA growth for each period is substantially lower than that of GVO, and much stronger Gerschenkron effect is observed (for

post-benchmarks in the 1990s) when using GVA, which is largely due to the declining value added ratio. For the earlier period (the 1980s) the later benchmarks do not correct for the Gerschenkron effect, but they show litter effect after the 1990s. This means that later benchmark weights have little downward bias while have strong upward bias!

3. As shown in Figure 4, the estimated Gerschenkron effect is much stronger for the reform period than for the pre-reform period. The overall growth, if based on 1987 weights, is much higher than if based on 1997 weights.

4. In Figure 4, we present three GVA indices compared with the official index of industrial GDP for the same period 1980-2006. It justifies an introduction of a geometric mean of the three results, which approximates the 1992 benchmark results! With our understanding of the price distortions that were still quite severe in the later 1980s, this implies that the earliest meaningful benchmark should be 1992.

FIGURE 4: ESTIMATED INDICES OF GROSS VALUE ADDED FOR CHINESE INDUSTRY, COMPARED WITH THE OFFICIAL ESTIMATES



Sources & Notes: Author's estimates. See Table 5 for details. The official index is directly from China Statistical Yearbook (NBS, 2007, p.59).

TABLE 3: ESTIMATED ANNUAL GROWTH RATES OF GROSS VALUE OF OUTPUT USING DIFFERENT WEIGHTS

	Industry	1987 weights		1992 weights		1997 weights	
		1952-1978	1978-2006	1952-1978	1978-2006	1952-1978	1978-2006
IC01	Food products	5.21	8.06	4.82	7.27	5.47	7.20
IC02	Beverages	10.01	7.15	9.97	6.75	10.01	7.20
IC03	Tobacco products	7.07	4.49	7.07	4.49	7.07	4.49
IC04	Textile products	6.18	7.11	6.03	7.03	5.98	6.74
IC05	Wearing apparel	4.71	11.91	4.61	11.73	4.69	11.88
IC06	Leather products	8.80	10.93	8.80	11.03	8.81	11.25
IC07	Wood products	7.73	6.25	7.88	7.60	7.92	7.05
IC08	Paper, printing etc.	11.93	9.87	11.79	9.94	11.70	9.93
IC09	Chemicals, petroleum	14.88	9.33	14.90	9.20	15.12	8.98
IC10	Rubber, plastic products	12.03	13.10	11.09	12.50	18.94	13.78
IC11	Building materials	10.41	10.51	9.95	10.10	9.92	9.83
IC12	Metals	17.12	5.08	18.76	8.44	17.76	9.02
IC13	Machinery, transport equip.	20.13	10.66	20.07	9.86	18.46	9.16
IC14	Electrical equipment	18.33	21.01	17.78	20.40	17.73	17.23
IC15	Other manufacturing	10.08	19.83	8.71	19.76	9.09	20.61
	Manufacturing	9.42	12.58	9.91	11.35	9.52	10.26
	Mining	12.75	3.85	13.58	3.75	13.02	3.97
	Utilities	15.77	9.00	15.77	9.00	15.77	9.00
	Total industry	9.78	12.12	10.28	10.93	9.99	9.76

Sources & Notes: Author's estimates.

TABLE 4: COMPARISON OF ESTIMATED ANNUAL GROWTH RATES OF GROSS VALUE OF OUTPUT AND GROSS VALUE ADDED USING DIFFERENT WEIGHTS

	Industry	1987 weights				1992 weights				1997 weights			
		Annual Growth of GVO		Annual Growth of GVA		Annual Growth of GVO		Annual Growth of GVA		Annual Growth of GVO		Annual Growth of GVA	
		1980-1993	1993-2006	1980-1993	1993-2006	1980-1993	1993-2006	1980-1993	1993-2006	1980-1993	1993-2006	1980-1993	1993-2006
IC01	Food products	12.75	3.21	13.59	5.32	11.00	3.17	11.83	5.27	11.57	2.55	12.41	4.65
IC02	Beverages	10.08	2.39	8.45	1.52	9.74	1.89	8.11	1.02	10.13	2.46	8.50	1.59
IC03	Tobacco products	6.33	1.40	5.39	2.86	6.33	1.40	5.39	2.86	6.33	1.40	5.39	2.86
IC04	Textile products	5.56	8.10	3.53	7.55	5.56	8.04	3.53	7.49	5.34	7.58	3.32	7.04
IC05	Wearing apparel	15.42	7.48	13.12	7.56	15.22	7.28	12.93	7.35	15.39	7.45	13.10	7.53
IC06	Leather products	12.32	7.57	10.24	8.02	12.62	7.49	10.53	7.94	13.25	7.33	11.15	7.79
IC07	Wood products	4.36	7.10	1.13	7.04	4.86	9.50	1.61	9.45	4.70	8.48	1.45	8.43
IC08	Paper, printing etc.	10.01	9.65	6.33	10.08	10.14	9.68	6.46	10.11	10.09	9.71	6.42	10.14
IC09	Chemicals, petroleum	7.44	11.56	4.50	9.70	7.24	11.52	4.31	9.66	6.83	11.40	3.91	9.54
IC10	Rubber, plastic products	13.28	13.53	10.67	12.43	12.87	12.74	10.27	11.64	14.38	13.62	11.74	12.51
IC11	Building materials	11.29	9.90	7.55	9.40	10.79	9.68	7.07	9.18	10.58	9.44	6.87	8.94
IC12	Metals	6.46	4.90	3.89	3.65	7.13	11.38	4.54	10.05	7.90	12.13	5.29	10.80
IC13	Machinery, transport equip.	11.12	12.04	8.23	10.91	9.26	11.81	6.41	10.69	9.61	11.08	6.75	9.97
IC14	Electrical equipment	16.39	28.00	12.94	24.97	15.52	27.99	12.09	24.96	13.48	23.68	10.11	20.74
IC15	Other manufacturing	19.50	22.33	15.76	22.59	18.94	22.33	15.22	22.59	20.58	22.56	16.81	22.82
	Manufacturing	10.41	15.53	7.83	14.44	9.22	14.32	6.68	13.24	9.23	11.97	6.69	10.91
	Mining	3.84	4.53	0.82	4.64	3.89	4.29	0.86	4.40	4.17	4.47	1.13	4.58
	Utilities	8.22	9.90	5.74	7.78	8.22	9.90	5.74	7.78	8.22	9.90	5.74	7.78
	Total industry	9.94	15.13	6.93	14.50	8.83	13.90	5.85	13.28	8.72	11.54	5.74	10.93

Sources & Notes: Author’s estimates.

5. Our results have further and more systematically confirmed the findings in Maddison and Wu (2008) and Wu (2007) that the official growth estimates are much less volatile that the estimates based on major commodities and input-output weights, suggesting that the real growth is smoothed out in official estimates.
6. Following this observation, we argue that the new findings are more plausible because they have picked up all the shocks in the economy.
7. Our findings justify however that the 1997 benchmark is more reasonable as we could see that (Figure 4 and Table 4) earlier benchmarks still overstate the growth after 2000s in particular. Nevertheless, given the higher unidentified component in our products, and considering higher growth cross all industries, we choose to be conservative. Therefore our final estimates in Table 5 are based on the geometric mean demonstrated in Figure 4.

VI. CONCLUSION

To be completed.

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This study revisits the debate of the real industrial growth performance in China by tackling two unsolved problems: substitution bias and effect of value added ratio change in Laspeyres quantity index. This new exercise is based on a substantially revised and updated time series of major industrial product quantities for the period 1949-2006. Price weights are used for product level aggregation. Benchmark year input-output table gross output and value added data are used for industry level index construction and inter-industry aggregation. To test for the Gerschenkron effect, three benchmark years 1987, 1992 and 1997 are used incorporated with full input-output tables for these years. Thus three sets of quantity output indices are constructed and compared. The results are a systematic and substantial improvement to the author's earlier work (Wu, 2002, RIW). Our findings lend a strong support to the upward bias hypothesis about the Chinese official growth estimates. For the period 1980-2006 that experienced unprecedented structural changes, our estimation for China's industrial GDP growth is finally a geometric mean of the three quantity indices. It is 9.4% per annum, which is 2.1 percentage points lower than the official estimates.

TABLE 5: ESTIMATED GVA GROWTH BY INDUSTRY, 1980-2006 (1997 = 100)

	IC01 Food products	IC02 Beverages	IC03 Tobacco	IC04 Textile products	IC05 Wearing apparel	IC06 Leather	IC07 Wood products	IC08 Paper, printing	IC09 Chemicals,	IC10 Rubber, plastic
1980	16.7	27.5	52.3	37.4	10.9	14.1	42.7	23.5	40.2	14.5
1981	21.1	32.2	58.9	40.0	11.9	17.0	44.0	23.8	40.7	13.8
1982	24.3	33.7	65.5	40.2	11.4	14.6	47.7	25.5	41.9	15.8
1983	25.5	39.1	67.7	39.5	11.6	13.9	52.3	28.0	43.2	19.2
1984	28.3	43.1	74.8	39.6	13.0	15.0	55.6	31.5	44.6	21.6
1985	34.2	47.9	83.5	43.8	14.6	17.1	33.9	37.5	48.8	25.4
1986	39.0	51.1	91.9	48.4	28.3	19.9	32.6	40.0	52.5	27.6
1987	47.5	56.9	91.0	47.6	23.2	18.0	33.5	40.5	47.9	25.3
1988	47.1	63.6	106.6	54.9	28.3	21.4	36.0	42.4	59.1	33.8
1989	49.8	58.8	106.4	55.0	28.0	20.8	34.2	43.3	54.4	33.7
1990	46.9	63.3	106.1	48.3	29.0	23.9	32.4	43.1	60.3	35.1
1991	56.6	66.2	100.1	50.1	30.4	28.4	38.6	45.7	64.4	41.1
1992	57.7	71.6	98.1	49.0	31.7	31.0	39.1	54.5	66.7	45.1
1993	78.0	77.9	103.5	58.1	53.9	52.4	51.2	52.7	68.9	55.7
1994	71.8	84.4	104.0	60.9	61.1	65.4	80.3	68.3	68.8	66.0
1995	104.6	98.9	105.0	86.3	98.8	156.9	138.9	97.1	93.6	83.2
1996	98.7	98.7	101.6	84.3	78.1	124.1	106.0	95.2	93.1	103.7
1997	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1998	67.5	110.1	109.9	71.6	73.3	58.9	38.4	63.9	87.1	66.2
1999	80.3	87.1	112.9	69.2	82.4	52.2	43.5	66.6	92.7	69.1
2000	90.5	91.9	119.0	74.5	71.5	73.4	42.0	71.9	96.1	72.5
2001	122.9	87.6	128.4	90.1	68.7	63.2	45.5	97.9	119.0	92.6
2002	140.9	89.8	140.2	96.3	77.4	64.1	59.8	139.9	140.7	123.7
2003	151.4	86.1	141.7	105.6	85.1	78.6	94.0	153.1	159.2	139.6
2004	138.5	88.9	145.0	123.6	100.1	94.0	104.5	168.0	178.4	199.6
2005	146.0	83.5	143.2	125.1	119.9	120.3	117.3	157.0	189.9	187.2
2006	148.6	93.1	149.4	146.3	137.7	141.0	144.3	184.5	227.9	248.6
1980-1997	11.1	7.9	3.9	6.0	13.9	12.2	5.1	8.9	5.5	12.0
1997-2006	4.5	-0.8	4.6	4.3	3.6	3.9	4.2	7.0	9.6	10.6
1980-2006	8.8	4.8	4.1	5.4	10.2	9.3	4.8	8.2	6.9	11.5

TABLE 5: (CONT'D)

	IC11 Building	IC12 Metals	IC13 Machinery,	IC14 Electrical	IC15 Other	Manufacturing	Mining	Utilities	Total industry	*Official Total industry*
1980	26.1	51.5	22.2	13.6	7.5	26.2	60.2	35.8	28.5	*14.2*
1981	27.3	46.0	19.9	12.9	8.3	27.0	58.5	36.8	29.2	*14.4*
1982	30.6	52.6	22.0	13.7	8.2	28.7	59.7	38.1	30.9	*15.3*
1983	33.0	61.2	26.6	16.8	8.1	31.1	62.4	40.5	33.3	*16.8*
1984	35.5	66.2	31.6	21.1	8.6	34.1	67.8	43.1	36.5	*19.3*
1985	40.3	68.4	40.4	29.3	10.5	39.3	68.9	46.3	40.9	*22.8*
1986	45.3	76.1	39.0	29.4	10.7	42.7	72.3	51.4	44.3	*24.9*
1987	41.4	120.4	38.4	27.1	17.0	42.5	69.4	49.5	43.7	*28.2*
1988	48.5	84.0	50.1	37.4	20.9	50.3	69.8	55.3	49.7	*32.6*
1989	46.8	84.1	46.3	37.4	43.3	50.7	70.5	57.7	50.2	*34.2*
1990	45.8	83.9	43.4	37.5	46.7	49.8	66.1	57.8	49.4	*35.4*
1991	55.5	91.5	49.5	45.2	37.7	54.8	69.6	61.4	54.2	*40.5*
1992	64.0	89.4	52.1	45.9	42.7	56.3	73.3	73.2	57.2	*49.1*
1993	64.1	92.1	54.3	57.3	51.5	63.7	67.9	73.9	62.1	*58.9*
1994	72.7	102.6	61.5	70.2	64.0	69.7	73.9	81.9	68.3	*70.1*
1995	91.8	118.4	93.7	116.2	91.7	100.4	89.8	88.9	96.6	*79.9*
1996	94.6	108.0	90.6	97.3	81.2	93.3	92.8	87.6	90.5	*89.8*
1997	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	*100.0*
1998	82.2	90.8	71.2	96.5	91.1	77.2	79.7	95.2	76.4	*108.9*
1999	83.5	95.1	75.1	119.1	103.4	82.4	73.6	99.8	81.0	*118.2*
2000	84.9	110.0	80.1	159.7	145.5	92.3	73.4	108.2	90.8	*129.7*
2001	108.5	142.7	98.1	194.6	192.8	115.8	86.2	131.2	116.3	*141.0*
2002	136.4	180.9	126.1	287.9	266.4	150.2	103.7	161.0	153.4	*155.1*
2003	153.8	199.7	148.4	447.5	371.7	188.1	107.6	172.1	189.7	*175.0*
2004	171.4	218.2	167.2	688.9	498.3	238.5	119.0	182.5	237.9	*195.1*
2005	172.7	229.5	166.3	775.9	588.4	260.8	109.7	170.8	256.0	*217.9*
2006	200.6	254.1	199.4	895.3	732.6	306.8	121.0	195.8	300.6	*246.3*
1980-1997	8.2	4.0	9.3	12.5	16.4	8.2	3.0	6.2	7.7	*12.2*
1997-2006	8.0	10.9	8.0	27.6	24.8	13.3	2.1	7.8	13.0	*10.5*
1980-2006	8.2	6.3	8.8	17.5	19.3	9.9	2.7	6.8	9.5	*11.6*

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